ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LIX, No. 12. CHICAGO, SATURDAY, SEPTEMBER 16, 1911. ISSUED WEEKLY.

BY THE

ELECTRICAL REVIEW PUBLISHING COMPANY

CHARLES W. PRICE, President and Treasurer.
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PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
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SUBSCRIPTIONS.

One Year, United States $3.00
One Year, Canada 4.00
One Year, Foreign Countries 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each . .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill, under the Act of March 3, 1879.

CONTENTS.

EDITORIAL:
The Campaign for Improved Street Lighting..... 553
The New Power Station of the Commonwealth Edison Company.. 554
The Pennsylvania Convention..... 555
An Example of Civic Progressiveness..... 555
Program of Convention of the Illuminating Engineering Society..... 556
Meeting of Empire State Association..... 556
International Municipal Congress and Exposition..... 556
Outing of St. Louis Section..... 556
New England Section Convention..... 556
Conference on Rubber-Covered Wire..... 556
R. F. Schuchardt..... 557
Milwaukee Manufacturers' Exposition..... 558
Convention of American Peat Society..... 558
New Northwest Station of the Commonwealth Edison Company..... 559
Mutual Benefit Association of the Mahoning & Shenango Company.... 567
Importing Canadian Power..... 567
Railway Merger in Boston..... 567
League of Electrical Interests..... 567
The Campaign for Improved Street Lighting..... 568
Water-Power Development in Austria-Hungary..... 576
Copper on Hand Decreased..... 576
Tungsten Lighting Installation on Michigan Boulevard, Chicago, Completed..... 577
Electric Sign Lighting..... 578
New York Subway Offer..... 582
Coal Production in Iowa..... 582
Fusing Wires in Hydrogen.—By A. A. Somerville..... 583
Rates in San Diego..... 583
The Value of an Example in Street Lighting..... 584
Photometry of Rectilinear Light Sources..... 584
Illumination of the World's Largest Transmission-Gear Factory—By Roscoe Scott..... 585
Park-Front Lighting: A Contrast..... 587
The Production of Aluminum..... 587
Pennsylvania Electric Association..... 588
Report of Lamp Committee..... 588
Steam Heating..... 589
Motors..... 590
Service Connections..... 590
Preservative Treatment of Poles and Crossarms..... 591
Data on Sag and Span Calculations..... 592
Overhead Line Construction..... 592
Electrical Appliances..... 593
Central-Station Service versus Isolated Plants..... 593
Making the Outside Bright.—By Ralph Beman..... 595
Electrolysis of Underground Pipes..... 597
The Fixation of Atmospheric Nitrogen.—II.—By John Woods Beckman 598
FINANCIAL REPORTS OF ELECTRICAL COMPANIES..... 601
AMONG THE CONTRACTORS AND SUPPLY MEN..... 601
NEW ELECTRICAL AND MECHANICAL APPARATUS AND APPLIANCES..... 602
CURRENT ELECTRICAL NEWS..... 609
PUBLIC SERVICE COMMISSION NEWS..... 609
RECORD OF ELECTRICAL PATENTS..... 614

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THE CAMPAIGN FOR IMPROVED STREET LIGHTING.

It has been contended by numerous writers that the street lighting in the average American city is far inferior to what can be seen in European cities. Despite the relative youth of our cities, this condition is now rapidly being improved. A strong movement in this direction set in a few years ago and is now receiving such impetus in many parts of the country that it deserves special consideration. An important feature of the recent development of American street lighting is that it has been confined almost entirely to electric lamps. Each year sees the percentage of gas and other non-electric street lamps diminishing.

The fact that so much consideration has been given to the decorative character of most recent American street-lighting installations is a very favorable indication of still further developments. It has been difficult to get municipal authorities interested in street-lighting betterments when these involved any additional outlay. The managers of lighting plants found a more ready hearing from the merchants and property owners along business streets. They readily saw the commercial advantage of brighter and more attractive streets; they have supplied the backbone of nearly all the improved lighting of business streets and it is only natural that special efforts were made to make these installations attractive.

In the illustrated descriptions of typical decorative street-lighting installations in another part of this issue is given a good idea of the variety of ways in which this work has been initiated and carried out and of the results achieved. Being obtained from the men that were in the thick of the campaign, these descriptions contain many valuable hints on how the work may be successfully undertaken and on some things to avoid. It is clear that the campaign is no longer confined to private lighting plants, nor to the large cities. Cities of a few thousand inhabitants may have excellent street lighting and that without prohibitive expense. Perhaps the most hopeful feature that stands out is that municipal authorities have been stirred to take an active part in the movement; they have come to realize that good street lighting is a valuable aid to the police, that it gives the community a high standing for progressiveness and makes for good will on the part of both citizens and visitors.

Other important features of decorative street lighting are

worthy of comment. Of these, one is that it has almost invariably enhanced the value of property along the street greatly beyond the cost of the improvement; in many cases this cost has been borne by the tenant and he has found himself penalized by increased rentals, despite which he has profited, however, by reason of increased business. The success of the installation in drawing trade has brought about similar installations in competing streets, so that additional attractions in electric signs, etc., have been necessary. The brightness of the street and sidewalk illumination has required a higher standard of window and store illumination, that is, more light within. Naturally the lighting interests have profited by both the latter features.

The old conventional lamp-post, so long used with gas, has found no place in the decorative installations. It has been replaced by distinctive standards of many designs and materials. Cast iron, although chiefly used, has found a competitor in pressed steel and reinforced concrete. Inexpensive and yet neat designs have been made of wrought-iron pipe. Concrete has become popular for park and boulevard lighting. The manufacture of ornamental standards has been greatly stimulated and types to suit any taste and size of appropriation are now available on the market.

Before undertaking any campaign for improved street lighting, consideration should be given to the manner of meeting the costs of the installation. If the lighting is to be decorative, uniformity of spacing is imperative, first in order to realize a truly esthetic result, and second, in order to permit the use of series circuits with their numerous advantages, such as longer life of the low-voltage lamps used, low cost of wiring and simplicity of control. If uniform spacing is to be attained, arrangements must be made to eliminate the possibility of a few objectors spoiling the plan. This may be accomplished best by adopting the most equitable method of financing the project, which is by the levy on a frontage basis of a special assessment on the abutting property owners to cover the initial cost of the installation and the agreement of the city to pay for its operation and maintenance. Such a division is eminently fair, in that those immediately benefited pay for the improvement just as they would for a new sewer or street pavement, and, on the other hand, the city recognizes the general public benefit by providing for the upkeep of the installation. Should it be impossible to secure the co-operation of the city authorities, it is necessary to appeal to the pride and enterprise of the property owners or tenants and urge them to undertake the proposition. In certain cases it is well to guard against too ambitious a scheme, because its expense may strike some as prohibitive and therefore defeat the entire proposition. Particular efforts should always be made to make the proposition a truly civic project and not merely a private undertaking subject to the parsimonious caprice of some individuals and the uncertain duration of residence of others.

THE NEW POWER STATION OF THE COMMONWEALTH EDISON COMPANY.

One of the most significant engineering feats of the current year is the construction of the new Northwest generating station of the Commonwealth Edison Company, Chicago. In this station the largest steam turbines ever built, of 20,000 kilowatts sustained maximum capacity each, are being installed, and a twin station of like size, which will bring the total capacity at this locality up to 240,000 kilowatts, is planned for the future. This construction is typical of the policy of the Commonwealth Edison Company, which under the admirable direction of Mr. Samuel Insull, has already made an enviable record for successful activity and remarkable energy in building up new business and providing for the increased demands on its system in ample time, and with the most up-to-date equipment.

In connection with the fact that the largest turbo-alternators ever built are being installed in the new station, it is interesting to note that this was true also of the Fisk Street and Quarry Street stations, and that the development of large and economical steam-turbine units was coincident with electric-power development in Chicago. The deliberate abandonment of the reciprocating type of engine, involving in the case of the Commonwealth company an investment in millions in a type of machinery that was practically unknown in the stress of commercial service, was a truly heroic undertaking, the successful conclusion of which has been amply demonstrated. The first 5,000-kilowatt vertical turbine ever built formed the basis of the design of the Fisk Street station, while the first 14,000-kilowatt turbine was installed in the Quarry Street station.

The new Northwest station is unquestionably a remarkable example of skill and foresight as applied to electrical supply. It embodies the most valuable and ingenious methods applicable to central-station design and will be a lasting tribute to the Commonwealth Edison Company and the individuals who have been responsible for it. One of the noteworthy features of the station is the boiler house. Here every facility for handling enormous volumes of coal with a minimum of labor is found. Coal enters the boiler-house basement in cars and is dumped into large bunkers from which it is conveyed to the overhead bunkers as required. By this arrangement the engineers have departed from the standard practice of placing heavy storage bunkers overhead, with the result that the cost of steel construction, which would have been necessary to support heavy overhead bunkers, has been materially reduced. Ten triple-drum boilers constitute the steam-generating equipment for each unit and a working steam pressure of 250 pounds is maintained. This pressure is unusual for land plants and it will be interesting to watch the outcome of this experiment.

In the turbine room much of interest is found. The generator leads from each unit are run directly to an auto-transformer where the pressure is raised to 9,000 volts. By

this arrangement the generator and auto-transformer are considered as a unit, the station having no control over the energy generated until it is raised to 9,000 volts. Two significant reasons are apparent for this plan; in units of this size it is cheaper to generate at 4,500 volts than at 9,000 volts; secondly, external reactance would be needed in any event and it is thus combined with and included in the auto-transformer.

A feature in connection with the switching at the Northwest station which is worthy of note is the innovation in the arrangement of the oil switches. The mechanism for these switches is isolated on the third floor of the switch house, where a burn-out or any trouble with the high-tension apparatus would not interfere with its operation. This arrangement also simplifies, to some extent, the switching and economizes floor space.

A complete description of this new station, with the first interior illustrations to be published, will be found in this issue.

THE PENNSYLVANIA CONVENTION.

The fourth annual convention of the Pennsylvania Electric Association marks the beginning of a new era of strength and influence in the history of that organization. As noted in our report of this meeting, appearing in this issue, the attendance somewhat exceeded 300, and this in spite of the fact that the meeting place was in the extreme northwest corner of the state, not very conveniently located as regards transportation facilities.

Perhaps the most significant feature of the convention, however, was the report of the secretary-treasurer showing the total membership to be approximately 1,000. When it is considered that the Pennsylvania Association has only been in existence four years, this figure indeed assumes significance and speaks well for the future of the Association.

The majority of the papers presented partook of the nature of a report submitted by a committee. Thus the information contained in the various reports represents the consensus of opinion of several rather than the experience of an individual. It has been the experience of the Pennsylvania Association that this arrangement tends to stimulate discussion, in addition to its other advantages, as members feel freer to discuss a report of a committee in an impersonal manner than to discuss or criticise the statements of an author of a paper.

The value of committee work is particularly emphasized in the report of the Committee on Overhead Line Construction. This report is a criticism of and a commentary on the report of the similar committee of the National Electric Light Association and entailed such a vast amount of work as to have been an impossible task for an individual. The section of this report dealing with a criticism of the National report on specifications for overhead crossings of electric light and power lines over railroad right-of-way, tracks, or lines of wire, called forth a lengthy and very spirited discussion. As expressed in a vote, subsequently taken, it was the consensus of opinion that the National report specified unnecessary and unduly expensive construction at wire crossings, which would be practically prohibitive for the smaller companies. Regardless of merits of each side of the case, the Pennsylvania committee is deserving of the utmost credit for its comprehensive and valuable report. Likewise the Committees on Lamps, Steam Heating and Rates, deserve credit for their untiring efforts in presenting valuable data before the Association.

In addition the various committees having charge of the convention arrangements should be complimented on their excellent work. The Program Committee probably established a precedent for state associations by having printed and distributed ten days before the meeting all papers and reports presented. This undoubtedly had a bearing on the intelligent discussion that took place by allowing the members sufficient time to formulate ideas on the various subjects.

Altogether the convention was a very successful one and demonstrates the advantages following the affiliation of a state organization with the National Association.

AN EXAMPLE OF CIVIC PROGRESSIVENESS.

Several months ago the city of Warren, O., inaugurated an ornamental street-lighting system using incandescent lamps to the exclusion of every other form of illuminant. The story of the campaign which culminated in the inauguration of the improved street lighting is similar in many respects to that which might be told with reference to dozens of other cities which have recently improved their street-lighting facilities. Warren, however, is possessed of a business men's organization that has taken more than usual interest in civic betterment and the result of this is the wide advertisement of the city as a place where enterprise may have its greatest opportunity for success. The work of this business men's association has attracted wide recognition throughout the state of Ohio and in many communities beyond its borders and within the last two months Warren has been visited by delegations from cities in many parts of the country seeking information respecting the Warren idea. One of the important features of the Warren idea is the close co-operation which has existed between the manufacturers, the real-estate interests, the storekeepers and merchants, and the central-station company. These interests have co-operated upon every important civic movement and the result is apparent in the healthy growth which has come to every department of endeavor in that community. In too many instances civic improvements are retarded because of the wall of indifference which has been built up between the interests most concerned. A study of the Warren idea is therefore suggested in those places where a community of interest is not now established.

Program of Convention of the Illuminating Engineering Society.

The fifth annual convention of the Illuminating Engineering Society is to be held at the Congress Hotel, Chicago, Ill., September 25, 26, 27 and 28. There will be six half-day sessions devoted to the reading of papers and reports. There will be a reception and dance on Monday evening and a subscription banquet on Wednesday evening. Automobile trips and other entertainments will be provided for the ladies.

The following papers and reports will be presented:

Presidential address, "The Relations of Physico-Physiological Research to Illuminating Engineering," by A. E. Kennelly.

Report of Committee on Nomenclature and Standards, by A. C. Humphreys, chairman.

Report of Committee on Progress, by Louis Bell, chairman.

Symposium on Illuminating Glassware, by Bassett Jones, Jr., A. J. Marshall, L. W. Young and C. H. McCormick.

"The Manufacture of Glass from the Viewpoint of the Illuminating Engineer," by E. H. Bostock.

"An Analysis of the Requirements of Modern Reflector Design," by F. L. Godinez.

"Recent Small Gas-Lighting Units," by F. H. Gilpin.

"The Production of Natural Gas from the Illuminating Engineer's Standpoint," by G. S. Barrows.

"Recent Developments in the Manufacture of Incandescent Lamps," by J. E. Randall.

"The New Quartz-Tube Mercury-Arc Lamp," by George C. Keech.

"The Law of Conservation as Applied to Illumination Calculations," by A. S. McAllister.

"The Photometry of Lighting Units of High Intensity," by George H. Stickney and S. L. E. Rose.

"Photometry at Low Intensities," by Louis Bell.

"Evaluation of Lamp Life," by P. S. Miller and L. J. Lewinson.

"Distribution of Luminosity in Nature," by H. E. Ives and M. Luckiesh.

"Light Distribution—Its Influence Upon Illuminating Efficiency and Visual Acuity," by A. J. Sweet.

"Resume of Legislative Enactments on Illumination," by E. L. Elliott.

"Selling Illumination," by F. B. Rae.

"Influence of Surroundings and Lighting Systems on the Illumination Required," by J. R. Cravath.

"The Analysis of Performance and Cost Data of Illuminants," by Ward Harrison and G. H. Magdsick.

Meeting of Empire State Association.

The annual meeting of the Empire State Gas and Electric Association will be held in the hall of the Engineering Societies Building, 29 West Thirty-ninth Street, New York City, on Friday, October 6, starting at 10 a. m. The program will consist of the reports of numerous committees and the discussion based upon these reports. There will also be some discussions on several of the recent opinions of the Public Service Commission which are of particular importance and also of the question as to the extent to which public-service corporations should enter into civic relations.

The election of officers for the ensuing year will take place at this meeting.

Those attending the meeting will lunch together at the Engineers Club during the noon recess.

International Municipal Congress and Exposition.

One of the sessions of the Municipal Congress, to be held in Chicago, Ill., September 18 to 30, will be devoted to "Public Utilities." B. J. Arnold will preside and addresses will be made by H. M. Byllesby and Edward W. Bemis. Among the speakers at other sessions are President Taft, Ex-president Roosevelt and Senator La Follette.

The exhibits will include a variety of electrical apparatus, especially in connection with municipal problems. The Commonwealth Edison Company, of Chicago, has installed an exhibit representing its system of distribution.

Among the exhibits of cities will be Denver's street lighting.

Outing of St. Louis Section.

The St. Louis section of the National Electric Light Association held its second annual outing at Ramona Park on Saturday, September 9. The afternoon and evening were devoted to baseball, boating and other sports, and dancing. A regular series of field events was held including a 100-yard dash for fat men and a hobble-skirt race for the ladies. The offices of the company were closed in the afternoon.

New England Section Convention.

The New England section of the National Electric Light Association will hold its fall convention at Bretton Woods, N. H., September 27, 28 and 29, in the Mount Washington Hotel. The following papers will be presented: "Synchronous Condensers," by C. T. Mosman; "The National Electric Light Association System of Accounting as Applied to Small Plants," by H.E. Gidney; "The Wire-Type Tungsten Lamp," by Norman Macbeth; "Application of Electricity to Domestic Uses," by W. H. Vorce.

Special cars will leave Boston, Mass., for Bretton Woods at 9:25 a. m. on September 27. Reservations should be secured from the master of transportation, S. J. Lent, 70 State Street, Boston.

Conference on Rubber-Covered Wire.

A conference was held on August 9 in New York City, between the Underwriters and the manufacturers of rubber-covered wire. The conference was called at the request of the wire manufacturers, who desired that inspection of rubber-covered wire made under the new National Electrical Code specifications should be conducted on a uniform basis throughout the country. The wire manufacturers insisted that, as the matter was of so great importance to them, they should have a voice as to the carrying out of the tests on rubber-covered wires.

For the past three years, the Underwriters have carried on their own laboratory and testing bureau, while most of the wire manufacturers have joined together and maintained a wire inspection bureau. These two bureaus have not worked in harmony.

As a result of the conference, the inspection of wires will be undertaken entirely under the supervision of the Underwriters' Laboratories. The Subcommittee on Wire of the Electrical Committee of the National Fire Protection Association is to be continued and is to include three representatives of the Underwriters and three representatives of the wire manufacturers subscribing to the Underwriters' Laboratories inspection service. This committee is to be a committee on the laboratories inspection methods and it is expected that there will be worked out a single and universally applicable method for factory and field inspection of rubber-covered wires. This will carry with it the use of a single form of label.

R. F. Schuchardt.

The Commonwealth Edison Company, universally known as the company with "big" policies, is building, in Chicago, a generating station that, for the present at least, will be the largest steam-driven power station in existence. Mere bigness, however, is not its only characteristic, for, in spite of the rapid advances that are being made in electricity supply stations, the Northwest Station will not soon lose its prominence as the exemplification of the best in central-station design. The design and installation of the entire electrical end of this notable station is in charge of R. F. Schuchardt, electrical engineer of the company and recognized as one of the prominent central-station engineers.

R. F. SCHUCHARDT,
Electrical Engineer, Commonwealth Edison Company.

Rudolph Frederick Schuchardt was born in Milwaukee, Wis., December 14, 1875. He attended public and private schools in that city and in 1893 entered the electrical engineering course of the University of Wisconsin, graduating in 1897. During his summer vacations, in order to gain practical experience, Mr. Schuchardt worked in the shops of the E. P. Allis Company, at Milwaukee.

Upon graduation Mr. Schuchardt entered the employ of the central station at Janesville, Wis., but soon after resigned to accept a position on the staff of F. B. Badt & Company, of Chicago, consulting engineers and manufacturers' representatives. In June of 1898 he entered the employ of the Chicago Edison Company as night operator in the then new storage-battery substation on Adams Street, and shortly after was sent to Omaha to take charge of the company's exhibit at the Trans-Mississippi Exposition.

When Mr. Schuchardt returned to Chicago at the close of the exposition he was promoted to the statistical department of the Edison company, and a year later was transferred to the testing laboratory. In 1903 the first 5,000-kilowatt turbogenerators to be used for power generation were placed in operation in the Fisk Street station and he was assigned to take charge of the electrical operating force there. While holding this position Mr. Schuchardt organized a school for operators which met with instant success. He also devised and patented a phase-rotation indicator for assisting in making correct connections in the construction work. This device has since been found a valuable help and time saver on distributing systems, as well as in construction work.

In 1905 Mr. Schuchardt was placed in charge of engineering and in November, 1906, became engineer of electrical construction. In July, 1909, he was appointed electrical engineer of the company, succeeding Peter Junkersfeld, who was made assistant to the second vice-president. In addition to Mr. Junkersfeld only one other man has held the position of electrical engineer, he being Louis A. Ferguson, now second vice-president.

As electrical engineer, Mr. Schuchardt is in charge of all engineering work of the company, the most important part of which at the present time is the design of all electrical features of the new Northwest Station, a plant in which the first 20,000-kilowatt turbogenerators are being installed.

Mr. Schuchardt is active in engineering societies, having contributed many valuable papers and taken part in discussions on various pertinent subjects. In 1897, although just having been graduated from college, he presented a paper before the Northwestern Electrical Association entitled, "Electricity Meters of Today." Among other papers are one on "The Rotary-Converter Substation," read before the Western Society of Engineers in 1907, and another on "The Protection of High-Tension Transmission Systems," read before the Chicago branch of the American Institute of Electrical Engineers in 1908. At the recent convention of the A. I. E. E. in Chicago he, in collaboration with E. O. Schweitzer, presented a very interesting paper on "The Use of Power-Limiting Reactances with Large Turbo-Alternators."

Mr. Schuchardt was a contributing editor of the *Cyclopedia of Engineering* of the American School of Correspondence and was the first editor of the *Edison Round Table,* a monthly publication of the Commonwealth Edison Company. He compiled the data upon which F. G. Baum's work on "Transformers" is based and has made several contributions to the technical press. He served as president of the Chicago Electrical Association in 1901, and was one of the engineering experts in the notable street-lighting arbitration case at Colorado Springs in 1907.

Mr. Schuchardt is a member of the American Institute of Electrical Engineers and the Western Society of Engineers, the latter organization having presented him with the Octave Chanute medal for his paper on "The Rotary-Converter Substation." This medal is presented annually for the best paper read before the Society during the previous year. He is a member of the Illuminating Engineering Society, having been elected chairman of the Chicago Section for the current year.

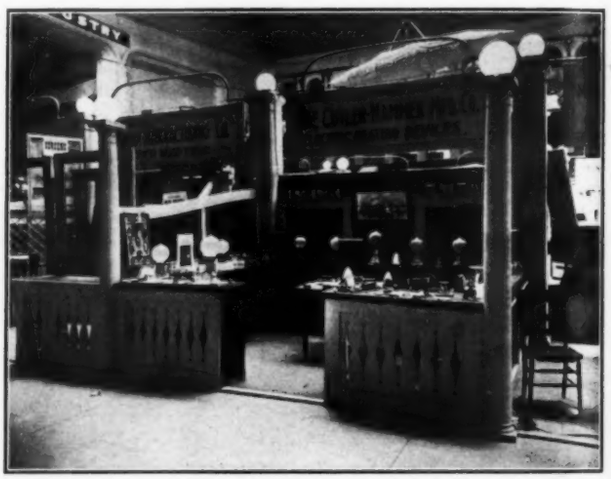
Mr. Schuchardt is also a member of the University Club and the City Club of Chicago.

Milwaukee Manufacturers' Exposition.

The Milwaukee Manufacturers' Industrial Exposition held September 2 to 12 proved very popular. On several nights it was necessary to close the doors about 8:30 p. m. as the crowds exceeded 16,000. Many were turned away on these occasions.

As in all expositions of this kind at the present time electricity played an important part, both in the lighting and in providing the power for working exhibits. On Fifth Street, from Grand Avenue to Cedar Street (where the Auditorium building is located) and on Cedar Street, from Third Street to Sixth Street, arches of incandescents blazed the way. At Grand Avenue and Fifth Street and at Third and Cedar Streets, large electric signs were stretched across the street, bearing the words "Auditorium" and a hand pointing in the direction of the exposition building. The current for these lights was furnished by the Milwaukee Electric Railway & Light Company, while the 220-volt sixty-cycle three-phase current for use in the Auditorium, was furnished by the Commonwealth Power Company, which furnishes this building and many other downtown buildings with electricity and steam for heating.

MAIN HALL OF AUDITORIUM.



SOME MILWAUKEE-MADE PRODUCTS.

One could well believe that Milwaukee is the second city in the country in point of diversity of products manufactured. The slogan recently adopted: "Name It, Milwaukee Makes It," has been well selected. There were many interesting electrical exhibits.

Allis-Chalmers Company had a three-horsepower alternating-current motor operating a compressor used in connection with a compression tank. The motor was controlled by a diaphram pressure governor. For demonstrating purposes an automobile tire was inflated. A centrifugal pump, a portable compressor set, alternating-current and direct-current motors and transformers were displayed.

The Andrae Company showed a country-home lighting plant, generator, generator and charging panel and batteries. Northwestern dynamos and motors were also shown and the coils and interior view of an armature.

Electric heating devices and pendent, feed-through, surface and fixture canopy switches were on exhibition at the booth of the Cutler-Hammer Manufacturing Company. Two lady demonstrators did a day's ironing each day with Cutter-Hammer irons. The instantaneous portable water-heaters attracted hardly less attention, but caused greater wonder. Three and four-quart sizes were in constant operation as were also the disk stove, radiators and curling-iron heaters. The new feed-through switch and canopy switch received much attention.

The H. W. Johns-Manville Company gave away samples of asbestos. Noark fuses, linolites, pipe and boiler coverings, roofings, etc., were displayed in this booth.

The Mechanical Appliance Company had in operation a small motor-generator set and exhibited Watson motors, horizontal and vertical types. They also showed an electric farm-lighting outfit.

The National Brake & Electric Company showed the National straight air-brake equipment, the type used in Milwaukee cars. Several portable air compressors were also on exhibition.

The Pawling & Harnishfeger Company had a grab bucket in operation. The installation was complete with motor, controller, crane cab, etc.

In the center of the main hall of the Auditorium the Milwaukee Electric Railway & Light Company had its large exhibit. The booth, octagonal in shape, had an arched roof covered with small frosted lamps and above this was a large sphere of lamps about six feet in diameter. From any of the main aisles the words "The Electric Company" could be seen. Inside the booth a Watson motor was operating a duplex pump, controlled automatically by a Cutler-Hammer gauge-type regulator. The General Electric rectifier was also in operation and the clapper-type switches on a Cutler-Hammer self-starter panel were operated. Hotel Pfister, where this panel is to be installed, recently abandoned its isolated plant and has contracted for central-station current. The company's new-business-department men were very busy and no doubt will benefit much by being brought in contact with prospects.

In the Brewers Association exhibit, bottle washers, rinsers, crowners, corkers, labelers, and fillers were each operated by individual motors. Many other exhibitors had working exhibits. About sixty to seventy horsepower of motors were in use.

Convention of American Peat Society.

The fifth annual meeting of the American Peat Society will be held at Kalamazoo, Mich., September 21, 22 and 23.

New Northwest Station of the Commonweath Edison Company.

Steam-Driven Power Plant Being Equipped with 20,000-Kilowatt Units.

Chicago, the great central market as it is called, covering 196 square miles of territory, and having a rapidly growing population, which already exceeds 2,250,000 is a pioneer in the electric-service industry. Such a population requires a vast system of electricity supply for residence and business lighting, and an endless variety for power purposes, including general and elevator power for business blocks, power for manufacturing, and power for hundreds of miles of surface and elevated transportation lines.

TURBINE ROOM, NORTHWEST STATION, UNIT NO. 1 SHOWN IN FOREGROUND.

It is fitting, therefore, that there should be erected in Chicago, what will be known as the largest and most complete steam-driven power station in existence, the Northwest station of the Commonwealth Edison Company. This station combined with the Quarry Street and Fisk Street stations, together with the underground transmission system, forms the largest and most comprehensive universal electric-power system in the world. It is of particular interest to note that steam-turbine generating units are used exclusively in each of these three stations, and that the development of large and economical steam-turbine units was coincident with the electric-power development in Chicago.

The first 5,000-kilowatt Curtis vertical turbine ever built was the basis of the design of the famous Fisk Street station, and was put into commercial service in that station on October 2, 1903. This pioneer unit was followed by three more of the same size; then six units having a continuous rating of 12,000 kilowatts were installed and the four 5,000-kilowatt units replaced with four 12,000-kilowatt units, making a total of ten units all alike and aggregating 120,000 kilowatts. The Quarry Street station was next equipped with six 14,000-kilowatt units and the new Northwest station, which is described in this article, will have an initial equipment of two 20,000-kilowatt units, the largest turbogenerators ever built. In a period of about eight years the total steam-turbine capacity will therefore have been increased from one unit of 5,000-kilowatts capacity to eighteen units aggregating 244,000 kilowatts.

The new Northwest station will contain ultimately six 20,000-kilowatt units and there is to be installed in the future a twin station of like size which will bring the total capacity at this location up to 240,000 kilowatts.

The station is located on the east portion of a large tract comprising 110 acres, consisting of two principal areas of about sixty and fifty acres connected by a strip 150-feet wide. The whole property is bounded on the extreme west by the Chicago & Northwestern right-of-way, on the east by the north branch of the Chicago River, on the north by Addison Street, and on the south by Roscoe Street. The cable distance from the center of the city is about seven miles, and that from the Fisk and Quarry Street stations to Northwest station about eight miles.

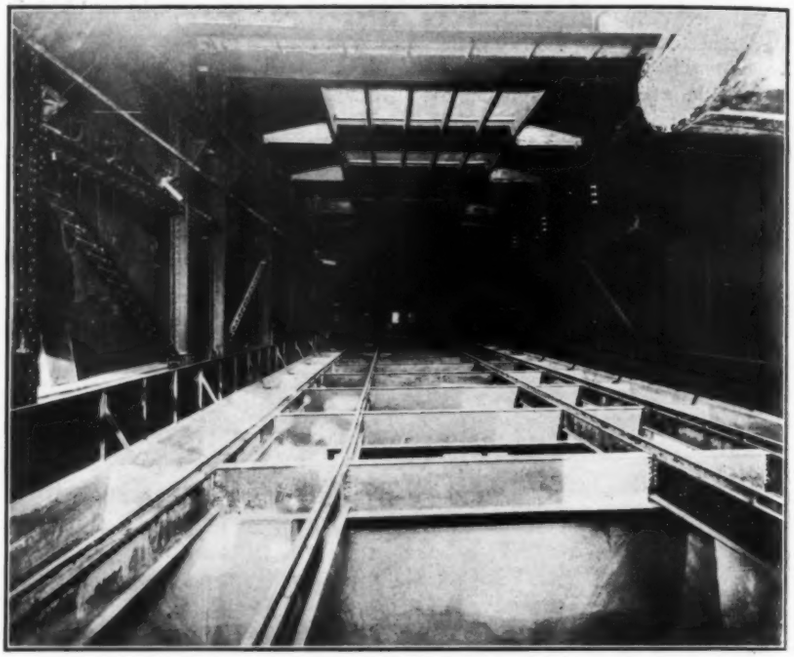
Ground was broken October 7, 1910, and the first station is now nearing completion as indicated by the accompanying illustrations, all the work that is still necessary on unit No. 1 being in such condition that it will be completed in a few weeks.

The general layout of the entire project is shown in the accompanying plat. As is indicated in this illustration the Northwest station consists essentially of four parts in three distinct buildings so arranged that they form one unit group. The four portions of the plant are the boiler house, the turbine room, the transformer house and the switch house. This station group is 411 feet long from east to west and when completed will be 294 feet wide. The north wall of the present station is a temporary one as this is just one-half of its ultimate size. The buildings are all of steel-frame construction with the outer walls of hard-burnt red paving brick. The foundations, basement walls, coal-receiving hoppers, cribs and tunnels are made of reinforced concrete. As seen in the accompanying exterior view the architectural design of the building exteriors is simple and massive.

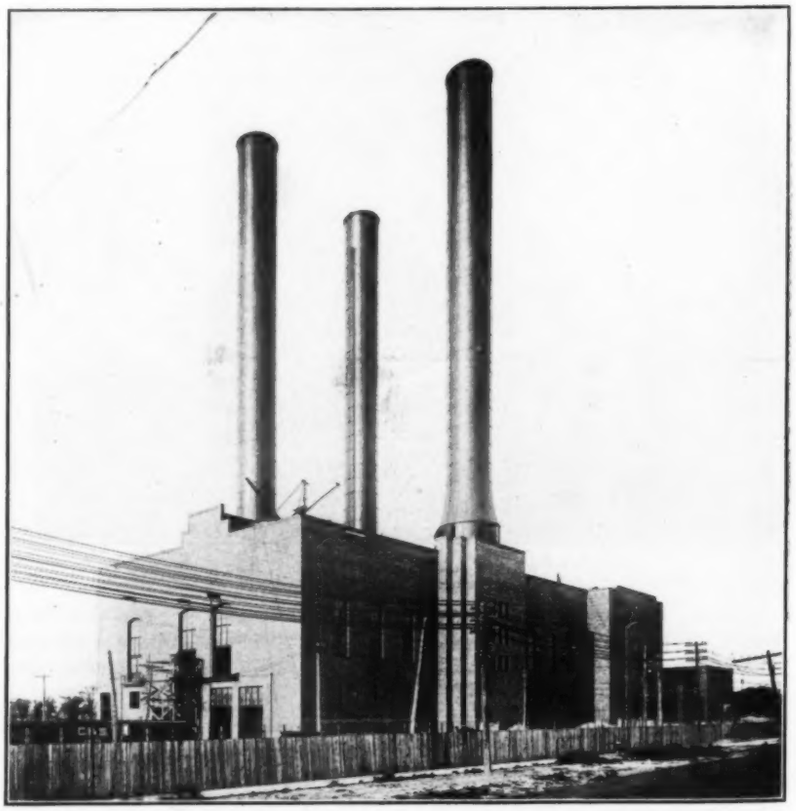
COAL HANDLING AND BOILER HOUSE.

The station is coaled from the Northwestern Railroad over a private elevated railroad entering the grounds from the west. As shown in the accompanying plat the railway is laid out in switchback fashion west of the two power houses as they will eventually exist. That portion of the railway inside the eastern grounds of the company is at grade. The switchback is arranged to provide smooth and easy descent for the cars coming from the elevated structure. Including the switchback there will be over three miles of this track eventually. It will be operated by the Commonwealth Edison Company with its own electric locomotives and third-rail 600-volt system.

Referring to the sectional elevation through the boiler house it will be noted that a large portion of the coal is handled under the boiler-room floor. In the boiler-house basement running centrally beneath each two rows of boilers are four railroad tracks. The two outer tracks are directly below the ash bunkers, the two inner tracks being for loaded coal cars. A traveling



COAL TRACKS IN BOILER-HOUSE BASEMENT.

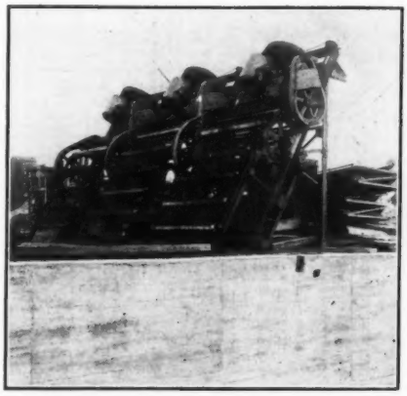


EXTERIOR OF NORTHWEST STATION LOOKING EAST.

coal-handling crane with grab-bucket spans these two tracks for use with such cars as have no hopper bottoms, but the hopper bottom cars that may be received will discharge directly into coal-receiving hoppers beneath the rails holding seventy-four tons for each boiler. Below these hoppers run another space with a track on which is a large traveling coal crusher spanning a thirty-four by thirty-six-inch bucket conveyor. The crushing machinery is in a deep pit and is provided with a by-pass for fine coal. The bucket conveyor encircles vertically the entire double boiler section discharging into overhead coal bunkers. The latter hold sixty-three tons for each boiler. The station bunkers thus have a total capacity of nearly 1,400 tons for each unit of ten boilers.

The coal storage on the ground will be very large, the space allowed between the twin stations being able to easily accommodate 250,000 tons. This capacity can be duplicated on the western portion of the property. Two electric coal bridges with five-ton buckets will ultimately span the coal pile. The removal of ashes is accomplished simply by dumping the ashes from the furnaces directly into cars placed on the ash-removal tracks previously referred to.

Referring again to the sectional elevation of the boiler-room section it will be seen that the boiler-room floor is on a comparatively high level, being in fact on the same level as the operating gallery, thus permitting the boiler-room operator to have an unobstructed view of the turbine room. The boiler room is 210 feet long and is provided with ten triple-drum boilers for each 20,000-kilowatt unit. The boilers for units No. 1 and 2 are located in two rows facing each other and are further divided into two batteries of five boilers each. Each boiler has 5,600 square feet of heating surface and is inclosed in a sheet-steel casing so as to ensure against any air leaks. The boilers are equipped with chain grate stokers. The steam pressure is 250 pounds with 150 degrees superheat. There is one brick-lined steel stack of seventeen feet internal diameter for each ten boilers. These rise 250 feet above the boiler room floor which is thirty-six feet above city datum, and is also twenty-one feet higher than the turbine room floor. The stacks are built on steel structures on the roof of the boiler house and are connected with the boilers by a steel-plate brick-lined smoke flue running over the top of the roof trusses. A slot is left in the roof on each side of this flue so as to give ample ventilation.



REVOLVING SCREENS AT INTAKE CRIB.

The steam piping has been designed in accordance with the most modern practice. A feature of the entire piping installation is the use of special castings eliminating as far as possible the use of joints. There is a sixteen-inch main steam header for each unit to which six-inch connections are run from each of the ten boilers. This header is installed in the boiler-house basement and is tied to the header for unit No. 2 by a ten-inch loop which also forms an auxiliary steam header for supplying pumps and auxiliary apparatus. The ten-inch loop is run in a special room in the turbine room basement.

The pump room is located in the boiler-house basement and contains two four-inch turbine-driven service pumps, two turbine-driven five-inch boiler-feed pumps and one motor-driven fire pump capable of supplying 1,500 gallons of water per minute. There is also installed a duplicate system of boiler-feed pumps for each unit. The fire pump discharges into a separate system of fire mains with the usual auxiliary and emergency connections. In connection with the boiler installation there is also installed in the pump room a motor-driven air compressor for cleaning purposes and a vertical hot-water heater for each unit.

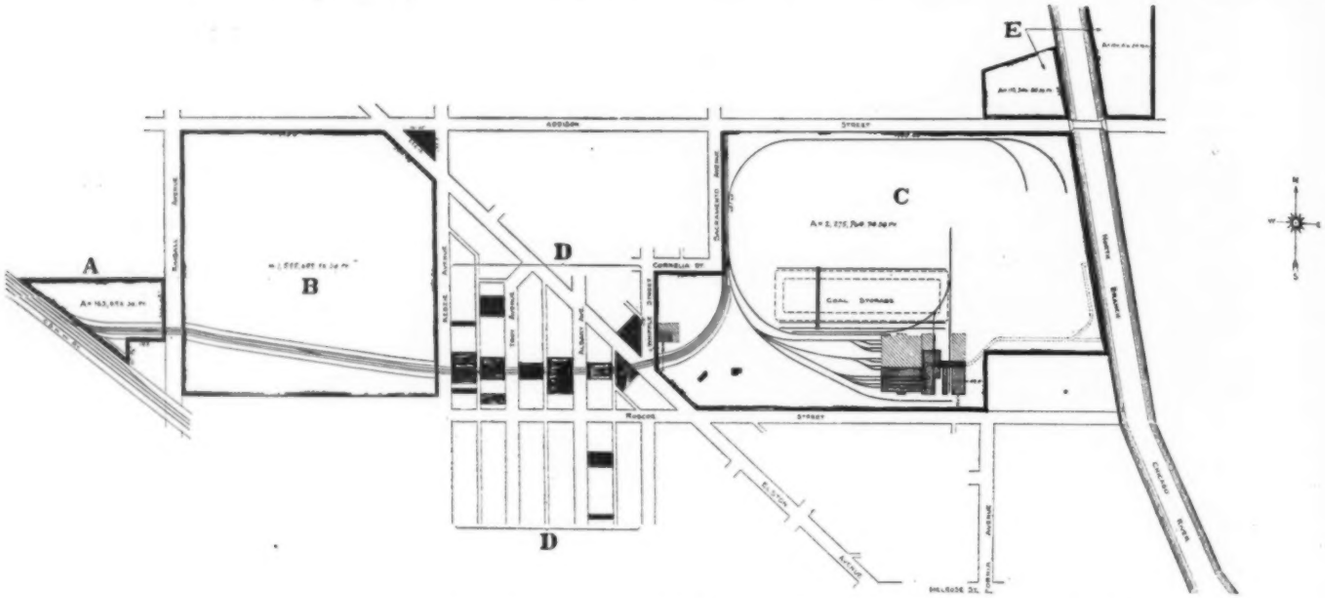
BOILER ROOM.

TRANSFORMER HOUSE.

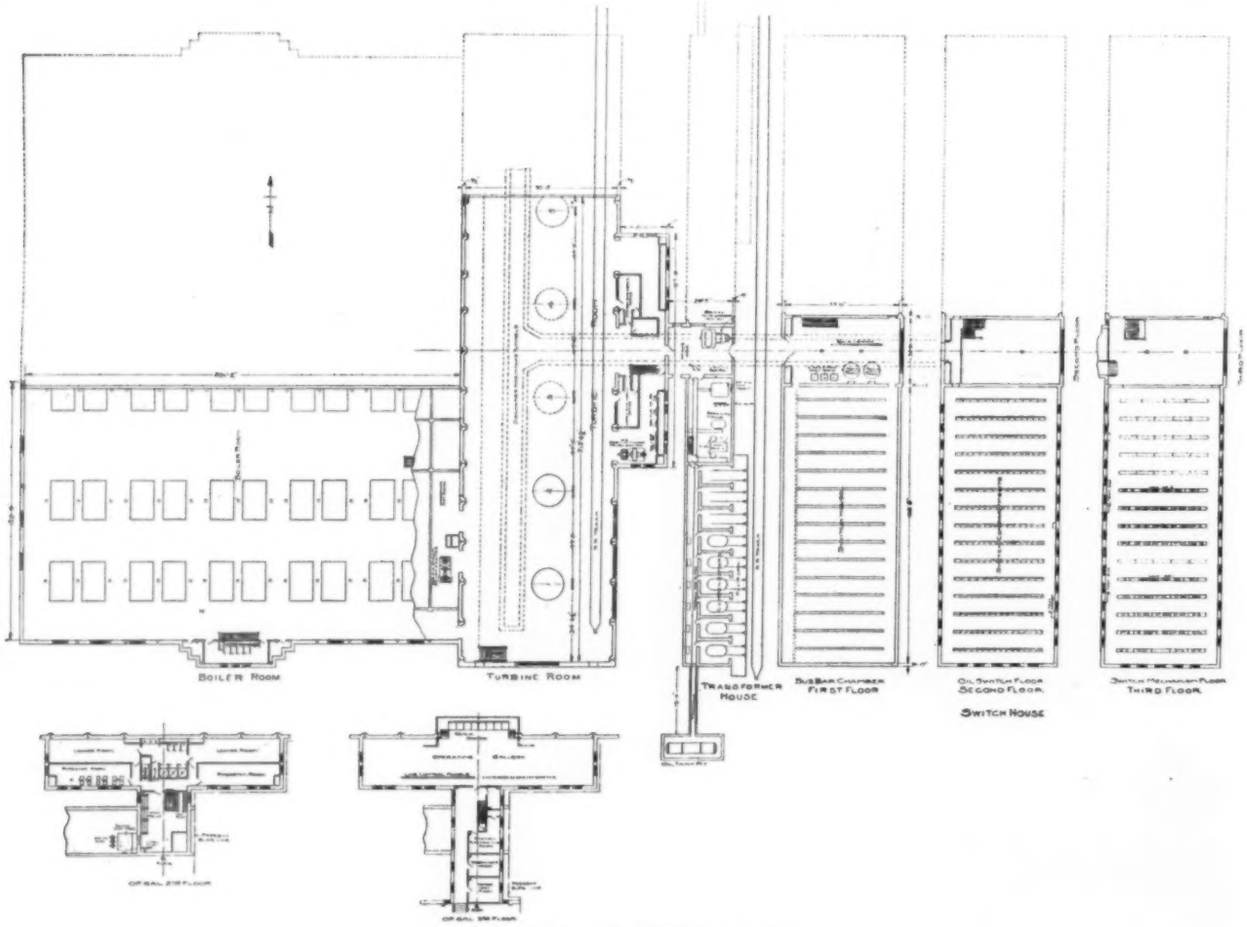
TURBINE ROOM.

The turbine room which is directly east of the boiler room runs perpendicular to the longitudinal axis of the boiler room. It is fifty-five feet high from the floor to the bottom of the roof

girders and is finished in white-enamel brick. It will contain, when completed, a row of six 20,000-kilowatt turbo-alternators although units Nos. 1 and 2 will constitute the initial installation. These units will consist of 4,500-volt twenty-five cycle three-phase alternating-current generators vertically mounted on five-stage 750-revolutions-per-minute steam turbines provided with condensers in the base and below the turbine-room floor. Ultimately the



GENERAL PLAT OF PROPERTY OF COMMONWEALTH EDISON COMPANY AT PLANT SITE.

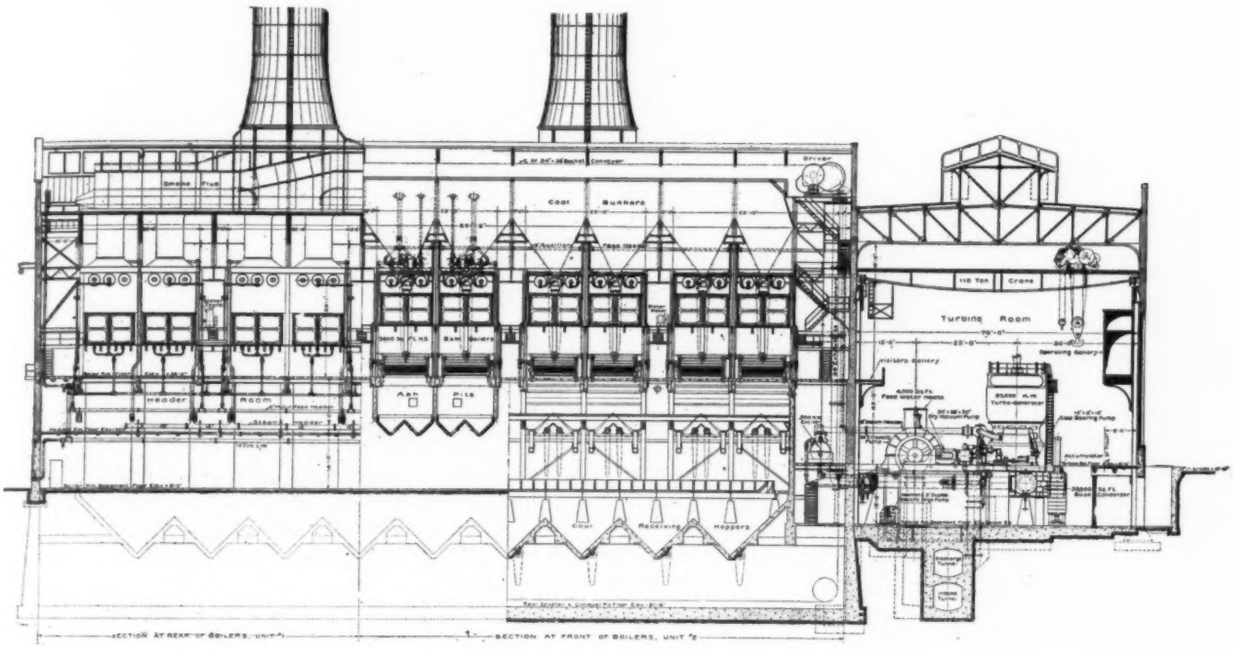


FLOOR PLAN OF NORTHWEST STATION.

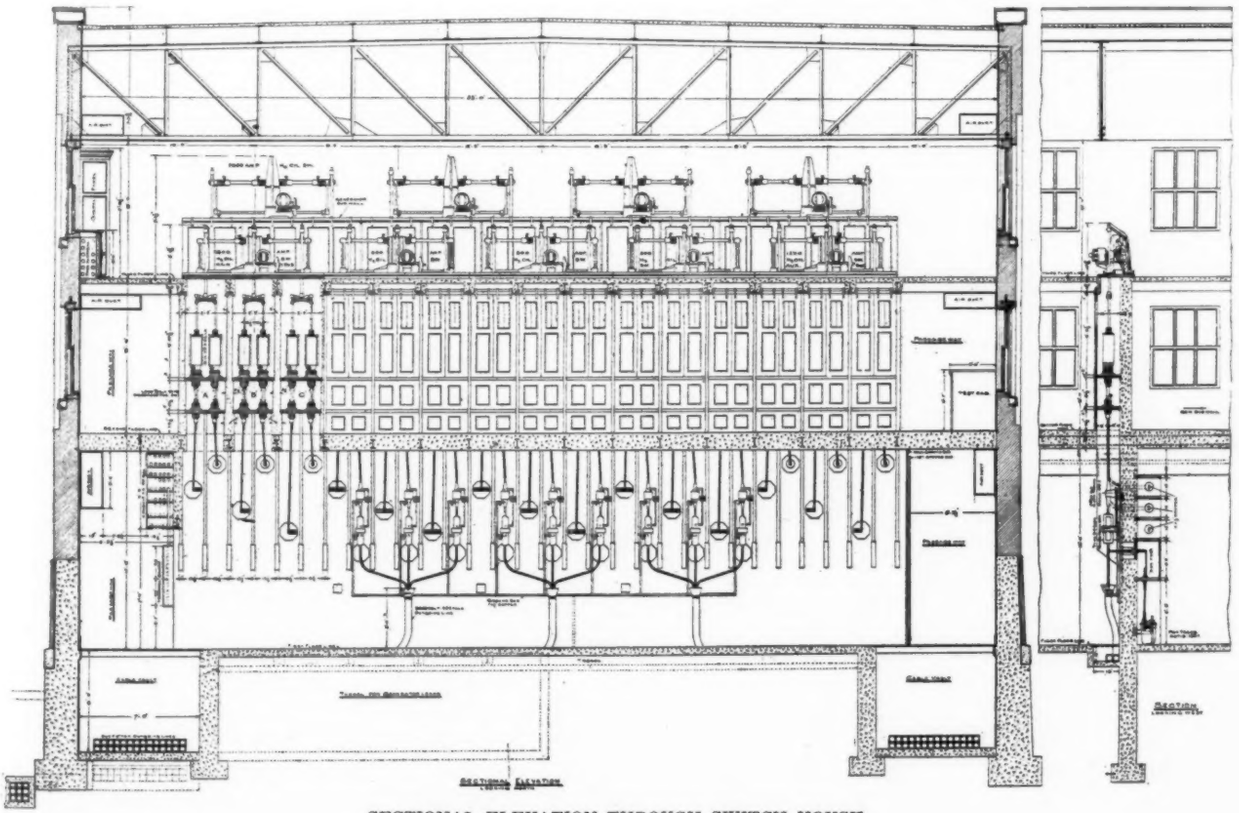
station will contain some sixty-cycle generators.

provided for the generators. In the basement under the turbine room is a

top of each turbine is a large metal duct. Small metal blades mounted



SECTIONAL ELEVATION THROUGH BOILER HOUSE AND TURBINE ROOM.



SECTIONAL ELEVATION THROUGH SWITCH HOUSE.

An important feature in this station is the ventilating and cooling system

free space into which fresh air is taken. Leading from this space to the

around the top of the rotor so as to act as propellers force a strong cur-

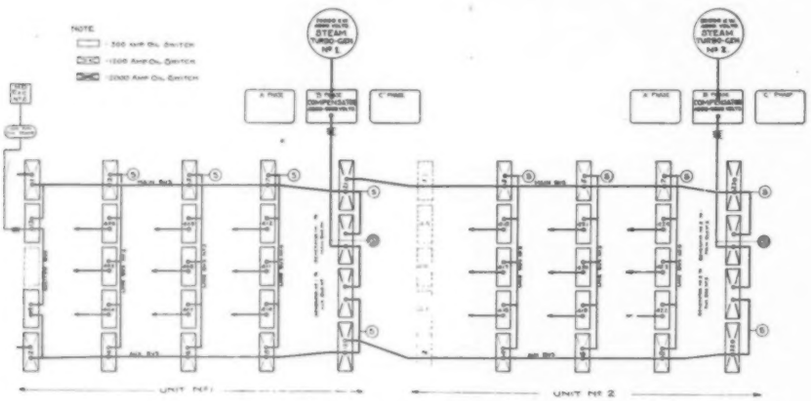
rent of cool air drawn from this basement passage down through the generator and out into the turbine room through the opening in the lower part of the armature shell, preventing heat radiation from the top of the steam section of the turbine from affecting the coils above.

The surface condensors on which these alternators are mounted are of the sub-base type located below the turbine-room floor. The height of the units above the floor is thus twenty-seven feet; their greatest diameter is 15.5 feet and they are on forty-four foot centers. The exciters and steam driven auxiliaries are also in the turbine room. There is a 300-kilowatt steam-driven exciter and a 200-kilowatt motor driven exciter for each unit. The latter is located in a bay directly under the operating gallery and comprises a 220-volt, three-phase induction motor driving a 200-kilowatt generator. The motor receives its energy from the 9,000-volt system through 300-kilowatt oil-cooled step-down transformers. The secondary voltage is 220. The steam-driven exciter comprises a steam turbine, receiving its steam from the ten-inch loop previously mentioned, direct connected to a 300-kilowatt generator.

The turbine room is so laid out as to receive excellent daylight and the artificial lighting is accomplished by means of flaming arc lamps set on the underside of the ceiling girders. A railroad track extends the entire length of the turbine room alongside the east wall and a 110-ton Morgan electric crane spans the turbine room.

Very elaborate provision has been made for the intake and discharge of the condensing water. A crib provided with motor-driven revolving screens has been constructed along the banks of the north branch of the Chicago River to which an intake tunnel leading to the turbine room is connected. The intake tunnel is of concrete construction approximately rectangular in shape and about ninety square feet in section. The discharge tunnel is built on top of the intake tunnel to a point about fifty yards from the river where it separates taking an opposite course to the bank of the river. The circulation of water in this system is about 210 gallons per hour per unit.

Of particular interest, also, are the oiling systems, the first of which is for lubricating the step-bearings on the turbines. For this service oil under pressure of 1,200 pounds is supplied to each unit by two pumps and is drained subsequently into an accumulator. The second system is for supplying oil to the upper bearings and turbine governors. This oil is supplied by two pumps under a pressure of 100 pounds. Oil from all bearings is drained into a tank located in the basement of the turbine room from where it is pumped to a filter room located in the basement of the boiler section. There is also an emergency drainage system by which all oil can be drained from the building to an outside over-ground tank.



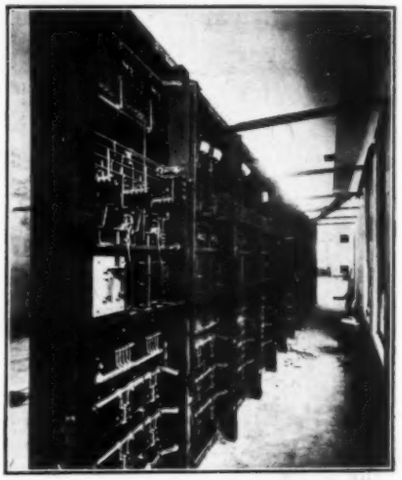
GENERAL WIRING DIAGRAM FOR UNITS NOS. 1 AND 2.

OPERATING GALLERY.

The operating gallery is in a bay on the east side of the turbine room. This bay or operating house consists of three floors and is connected with the switch house by a covered passageway leading over the transformer house. The latter is a one-story building located directly east of the operating-gallery bay and turbine room and like it has its major axis running north and south. The switchhouse is also a separate building containing three floors, and, like the transformer house to which it is adjacent and is connected, its long axis parallels that of the turbine room.

SWITCHING.

The generator conductors are brought down underneath the ventilating hood and together with a 750,000-circular-mil neutral cable connect with lead-covered cables running to the auto-transformers located in the transformer house. The generator leads are 1,750,000 circular miles in cross-section and two leads comprise a phase. These lead-covered cables, which terminate in "Electrete" bells at each end are mounted in concrete compartments separately for each phase. In order to detect faults in these cables there has been provided a special signalling device for warning the operators in case of trouble. If enough current flows to blow a fuse this operates warning bells which notify the attendants of the trouble.



REAR OF MAIN SWITCHBOARD.

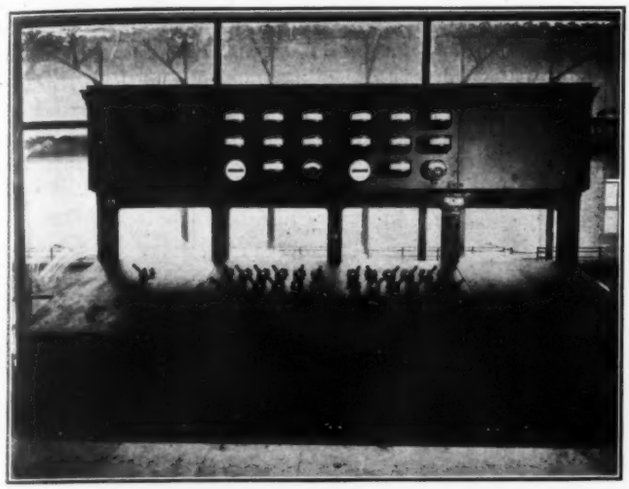
The field leads from the generators, which are 750,000-circular-mil lead-covered cables, are also brought down the ventilating duct and extend to the excitation switchboard located on the first floor in the operating-gallery bay where they can be connected to the excitation busses. These busses are supplied by the two exciters already mentioned and also, in case of emergency, by two storage batteries. The busses are maintained at approximately 125 volts.

The generator field-rheostats are motor operated, the resistance boxes being located on the second floor of the operating-gallery bay and the contact head on the top panel of the

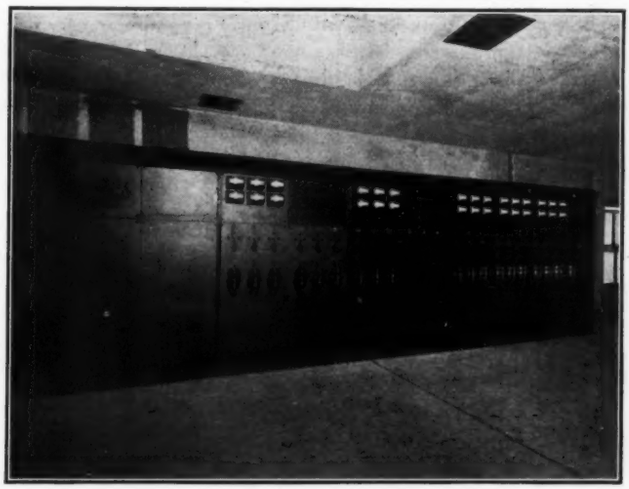
switchboard thus allowing very best ventilation. The field leads are connected with double-pole solenoid-operated circuit-breakers.

The batteries for emergency excitation current are of the Electric Storage Battery Company's make and comprise seventy cells with two end-cell switches. They are located in the basement of the operating-gallery bay together with a third storage battery which furnishes current for the operating busses from which the oil-switch controls etc. receive their supply.

On the second floor of the operating-gallery bay is located the turbine-room and operating attendants' quarters and also the rooms containing the field-rheostat boxes. The main operating room is located on the third floor and contains the generator and line switchboard. The generators are controlled from benchboards located here, while the line-control switches and instruments are placed on vertical panels. The operating gallery has a false marble floor under which all of the conduit containing all control and instrument wires are run.



BENCH BOARD IN OPERATING GALLERY.



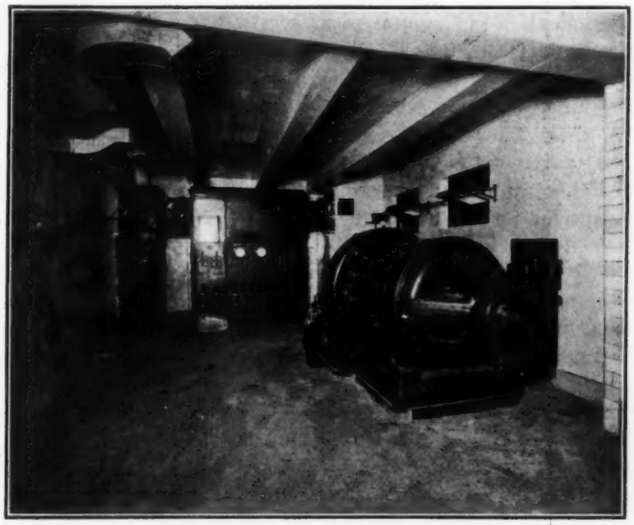
ONE-HALF OF MAIN SWITCHBOARD.

The lead-covered leads from the generators, after leaving the turbine room pass through a cable vault, shown in one of the illustrations, and continue in concrete compartments to their respective auto-transformers. There are three 3,333-kilovolt-ampere auto-transformers for each unit raising the generator potential from 4,500 volts to 9,000 volts. These transformers are oil-insulated and water cooled, with forced oil and forced water circulation. Each stands in a separate fireproof compartment and is placed on a truck which can be moved out to an unloading platform and transferred directly to the repair shops on a railroad track.

Provisions have been made for quickly dumping the oil from each transformer, in case of trouble, into an oil-tank pit outside. The oil is pumped from this tank by centrifugal pumps and forced through filters located at the south end of the oil-pump compartment. All oil is returned to an oil header to which connections are run to each transformer for refilling.

The neutral cable of each generator is connected to a busbar in the transformer house to which the neutrals of the auto-transformers are also connected. An oil switch connects this bus with the busbar connected to ground through a neutral resistance of approximately 2.5 ohms. The neutral switches and resistances are located in the passage way above the main passage along

DISTRIBUTING BOARD IN SUBSTATION.



EXCITER SET AND SWITCHBOARD.

the west side of the transformer house.

The 9,000-volt leads from the auto-transformers are covered with double-braided varnished-cambric insulation and are supported in a special vault in a similar manner to the high-tension busses. These leads terminate in the central portion of the switch house.

As already stated, the switch house has three floors. On the first floor are located the high-tension busses, the instrument transformers and the bells of the outgoing transmission lines. The line and generator busses run east and west while the main and auxiliary busses run north and south. The generator leads entering the switch house are connected to two 2,000-ampere oil switches, one connecting with the auxiliary bus and one with the main bus. There are also two additional 2,000-ampere switches for sectionalizing the main and auxiliary busses.

The line switches are divided in four groups of three and have a capacity of 300-amperes each. Each group is connected to the main and auxiliary busses through 12,000-ampere oil switches, making five switches in a row for each group of three lines. The busses are mounted in concrete compartments secured by bushing-type insulators. The main bus is mounted on one side of the wall under each row of oil switches, and vertical barriers, for the leads to the terminal bells of the line cables, are mounted on the other side.

On the second floor of the switch house is the oil-switch room, containing nineteen oil switches for each unit. Of these nineteen switches, nine are line switches, eight group and tie switches and two generator switches. A special feature in connection with the oil pots for these switches is that they are arranged in single instead of in double rows as in common practice. This arrangement makes for more economical spacing and also simplifies the busbar connections.

A view of the third floor of the switch house is shown in one of the accompanying illustrations. Here are placed all of the operating mechanisms of the oil switches, entirely separate from the parts carrying high-tension currents. The operating mechanisms are only slightly raised from the floor with the exception of the generator and tie switches, as shown.

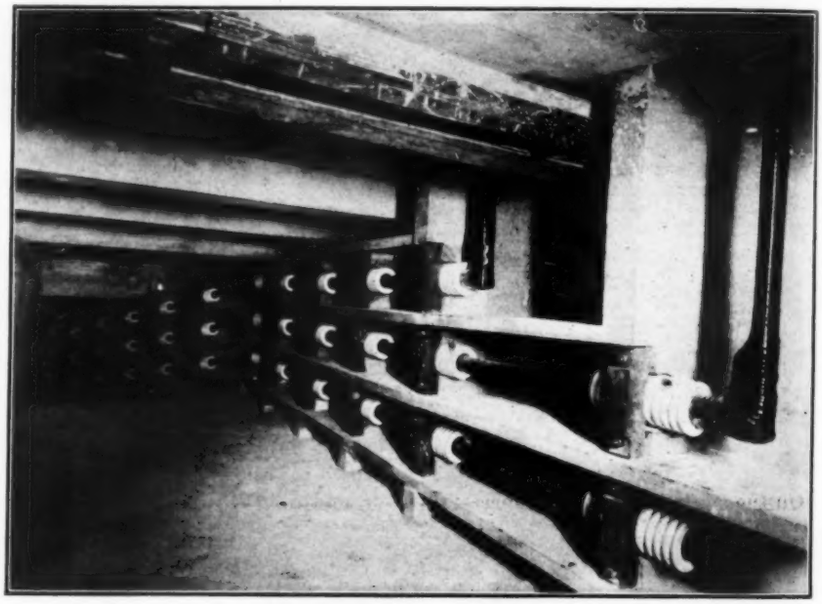
The above oil switches are controlled from the switchboard in the operating gallery, the conduit extending along the west wall on the third floor and then under the false floor of the operating gallery to the switchboard. The instrument-transformer leads extend from the terminal board at the end of each bus wall along the ceiling of the west passageway through a shaft through the false floor and then to the switchboard.

The generator board consists at present of two generator and one excitation panels, and is located in the glass bay projecting into the turbine room. This board will ultimately consist of eight panels, six generator and two excitation panels. The line switchboard is located adjacent to the east wall of the operating room and consists of four panels per unit. This board will be in two sections, one on each side of the entrance to the gallery, and containing switchboard space for three units on each side.

The switchboards are made of black Munson slate supported on ornamental angle-iron frames. The generator board is of the bench-board type with the meters mounted on the vertical slabs. A right-angle switchboard is located south of the generator board and contains miscellaneous instruments such as synchroscopes, integrating wattmeters for the generators, fire alarms, etc. The miniature busses mounted on the bench boards consist of wood strips enameled red and in connection with the customary pilot lamps for tracing the live connections indicates to the operator the condition of the system.

STATION SERVICE.

At the north end of the switch-house is located the substation containing the light and power transformers, switchboard, busses, and switching devices. All lamps and motors on the premises will be supplied with energy from sixty-cycle 115-230-volt circuits. Two 12,000-volt sixty-cycle lines are brought into the basement of the substation and connected to the busses mounted in concrete compartments. One of these lines is from the Quarry Street station and the other from the Whipple Street substation. Two 750-kilowatt Westinghouse three-phase oil-cooled transformers on the first floor of this substation step down the voltage to 220, the secondary being star wound with a tap brought out on each phase for 110-volt lighting service.



CABLE VAULT IN SWITCH HOUSE.

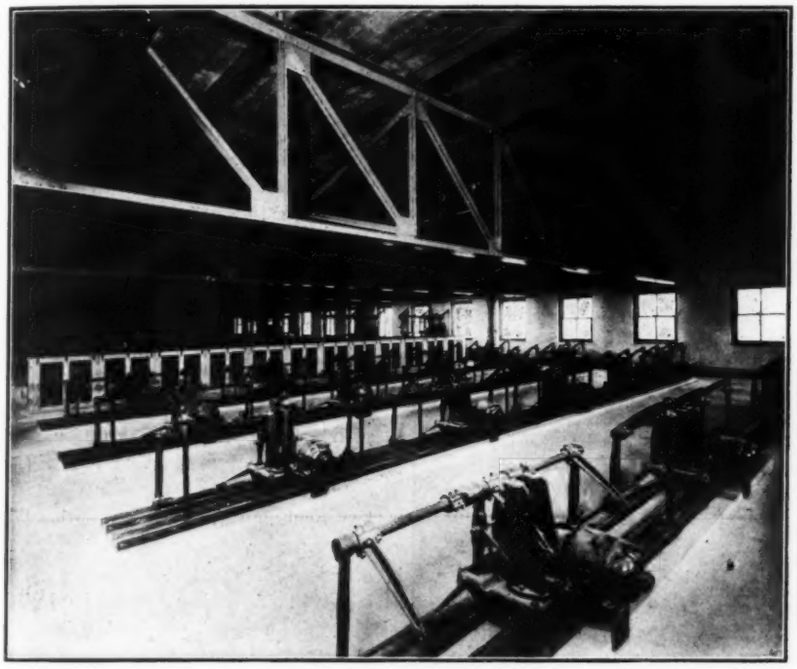
In addition to the two 750-kilowatt transformers there are six 100-kilovolt-ampere transformers connected to the 4,000-volt service and serving as a reserve to the above.

The main control board is located on the first floor of the substation just south of the transformers and is connected to two additional distributing boards, one in the steam-driven-exciter room adjacent to the boiler house, and the other in the transformer house. These boards consist of light and power panels on which are mounted the instruments and knife switches for controlling the various light and power circuits throughout the station. All motors used within the plant, includ-

ing the crane motors, are of the induction type. The motor load aggregates approximately 900 horsepower while about 2,100 incandescent lamps and fifty arc lamps are required for lighting purposes.

Of particular interest at the Northwest station is the testing set provided for testing generators and connections and transmission lines. For this purpose there is located in the north end of the transformer house a Westinghouse motor-generator set comprising a 500-kilovolt-ampere generator driven by a 200-kilowatt motor both mounted on a common base with the exciter direct connected to the generator shaft. The motor receives its energy from the 220-volt busses in the substation. The generator supplies 300-volt current to a step-up transformer provided with a series and shunt resistance connected in each phase, for the purpose of obtaining a good sine wave. The capacity of this step-up transformer is 500 kilovolt-amperes and it raises the voltage to 20,000, 40,000 and 60,000 volts. The high-voltage terminals of this transformer are connected with links and switches for obtaining the various voltages as desired. The series and shunt resistances are located on the second floor above the motor generator room. The shunt resistances are fixed with a capacity of 100 amperes while the series resistances are variable with a capacity of 1,000 amperes. From this transformer is run a lead-covered three-conductor cable to the second floor of the switch house terminating in cabinets containing plugging equipment for extending the test leads to the oil switches.

The Northwest station will start with fifteen out-going lines, three of which will be connected with Fisk street so that energy may be transferred either to or from this station as requirements indicate. The greater part of the current generated at this station, however, will be supplied to the northwest section of the city to take care of the rapidly increasing load being built up in that locality.



THIRD FLOOR OF SWITCH HOUSE CONTAINING OIL-SWITCH MECHANISM.

The architects of this plant are Holabird & Roche. The steam equipment was designed by Sargent & Lundy, consulting engineers, while all of the electrical equipment was designed by the engineering department of the Commonwealth Edison Company. The boilers were supplied by the Babcock & Wilcox Company, the turbine units and oil-switch equipment and electric locomotives by the General Electric Company; condensers by H. R. Worthington; railroad tracks and condensing tunnels by J. O. Heyworth, and steel construction by George W. Jackson, Inc. The George A. Fuller Company was the general contractor for the buildings.

Mutual Benefit Association of the Mahoning and Shenango Company.

The Mutual Benefit Association of the Mahoning and Shenango Railway and Light Company, of New Castle, Pa., met in its club rooms at No. 8 Cochran Way on Friday, September 1.

The meeting was called to order by Chairman L. B. Round. In the absence of Secretary J. L. Logan, Chester Smith was appointed to act *pro tem.*

After the roll call a paper was read by J. J. Weber on "The Fundamental Principles of a Technical Society." The paper was very well gotten up and covered unity with the employer. A lively discussion followed.

Then followed a monthly report of the efficiency of the members in their different lines of work by Chairman L. B. Round, which showed a great increase since May 1. Then came a closing address by Chairman L. B. Round on "General Principles of the Club."

Importing Canadian Power.

A suggestion that action be taken to induce the United States government to prohibit the importation of electrical energy from Windsor across the river to Detroit has been referred to the Public Policy Committee of the National Electric Light Association. The Ontario Hydro-Electric Commission is depending on Detroit as a field for the power it will carry along its new transmission line from St. Thomas to Windsor, without which the line could scarcely be made a financial success. The project to import energy from Windsor is meeting with strenuous opposition from the operating companies in Detroit.

Railway Merger in Boston.

The West End Street Railway Company, of Boston, Mass., has voted to merge with the Boston Elevated Railway Company. The Elevated Company for several years has operated the West End Company, which controls several surface lines, under a lease.

The merger will take effect under plans proposed by the Legislature, which practically insures for Boston two subways to be undertaken by the Elevated Company at once.

League of Electrical Interests.

The St. Louis League of Electrical Interests held an inaugural dinner and entertainment at the Mercantile Club, St. Louis, on September 8.

The Campaign for Improved Street Lighting.

Descriptions of Some Typical Installations.

For several years there has swept over the country a movement for the radical betterment of street lighting. It has resulted in a vast improvement in the aesthetic aspects of street lighting as well as in a marked raising of the standard of illumination. This has had two important benefits, first an immediate commercial advantage to the property owners and tenants along the streets improved and second a general public benefit to the entire community in making its streets more safe and in showing an enterprising and progressive civic spirit.

As the agitation for more modern and better street lighting gained strength almost simultaneously with the advent of the tungsten lamp, it was quite natural that most of the installations made in this connection employed that lamp and particularly in a cluster on an ornamental column or standard. Arc lamps of the newer types have been very effectively used in decorative street lighting in several of the larger cities where a rather high intensity of illumination was desired. Arch lighting of a more or less permanent character has been installed, but is gradually being replaced by the tungsten-cluster system.

Since the latter system is most representative of this movement, a few typical installations have been selected and briefly described below. Particular attention has been given to the origin of the crusade in each instance. The data have been obtained directly from the central-station managers and others, who were most concerned in bringing about the installation.

LOS ANGELES, CAL.

It was in the latter part of the year 1904 that the first meeting was held in the city of Los Angeles to discuss ways and means in connection with the installation of ornamental street lights. This meeting was, very probably, one of the first meetings that was held in the United States for the consideration of a radical change in the method of street illumination.

At that time there was an agitation for increased illumination on Broadway, Los Angeles, and the meeting in question was attended by a considerable number of people who owned property on that street and by representatives of the lighting companies. The object of the meeting was to discuss the kind of lighting, the manner of installation and the plans for raising the necessary funds to cover the expense.

The tendency at first was to adopt some kind of ornamental post from which arc lamps would be suspended, but in the discussions at the various meetings which were subsequently held, it gradually developed that the desire of the property owners and others interested pointed as much toward decorative lighting as illumination. The

DESIGN OF STANDARD IN FIFTH STREET, LOS ANGELES.

decision finally resulted in the form of a cluster of incandescent lamps on an ornamental post, or standard, which seemed to fit the requirements and which form has been reproduced, with certain minor changes, in scores of cities lying between the Atlantic and the Pacific oceans.

It is worthy of note that after the installation of ornamental posts had been completed on Broadway in Los Angeles, and pictures of this installation had been spread throughout the country by the electrical journals, the lighting companies of Los Angeles and the city officials were for awhile almost inundated with letters containing inquiries from all parts of the country asking for particulars concerning the installation and cost of operation of this method of ornamental street illumination.

The popularity which the use of these ornamental posts has developed is probably caused primarily by the decorative effect and secondarily by the general air of up-to-dateness which their use undoubtedly lends to the city.

From the standpoint of the Los Angeles lighting companies, it cannot be denied that ornamental street illumination has a tendency to detract from the effect of window displays along the streets, and for this reason has a tendency to restrict window and display lighting. Further, in the city of Los Angeles it has been found that the ornamental street lighting has had a depressing effect upon the use of electric signs—the opinion of those in authority being that projecting electric signs detract from the artistic appearance of the ornamental posts. Consequently, an ordinance was passed limiting the extension of electric signs to a distance of eighteen inches from the building. An eighteen-inch projection is not considered sufficient by most business men to obtain the best advertising results from the use of electric signs.

Notwithstanding these minor objections, the electric companies in Los Angeles are enthusiastic about the ornamental street lighting, as it lends a unique and distinctly attractive appearance to the streets on which the system is installed.

This method of lighting is highly satisfactory to the residents of the city, and has a pleasing effect upon the stranger within its gates. Originally the ornamental street posts were installed on Broadway in Los Angeles, as a means of drawing crowds on that street at night. The purpose of the ornamental lamps was so admirably accomplished that other main thoroughfares began to be jealous, and in self protection immediately adopted the same method of illumination. Therefore it took but a year or two to cover all the main arteries and lateral streets

in the business portion of the city with these ornamental posts.

As a means of drawing the public to any particular locality in Los Angeles, because of the increased illumination, the merits of the ornamental posts have largely ceased to exist. In other words, the entire business portion of the city is practically equipped with this method of lighting, and any street in the city which wishes to be incorporated in the shopping district, must necessarily be brilliantly illuminated.

The tendency has developed to extend this system of ornamental posts to streets of secondary importance, and this tendency has been the cause of considerable competition between various neighborhoods. There is little doubt that a very large area in the city of Los Angeles will be illuminated by means of ornamental standards in the near future, unless some other and better form of illumination comes to the front.

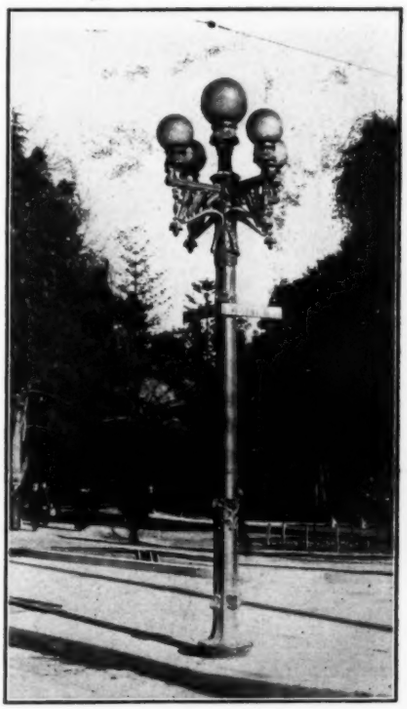
DESIGN OF STANDARD IN SPRING STREET, LOS ANGELES.

The method adopted, in regard to the first installation of ornamental posts in Los Angeles, was by means of raising money by voluntary subscription from the property owners along the street. The fact that a number of property owners failed to contribute their proportion, caused the framing of an act in the State Legislature known as the "Municipal Lighting Act," which was passed in 1905. All street lighting of an ornamental character has been installed under this law since its passage. Provision is made for taxing the property owners for the installation of ornamental posts on a pro rata basis. Experience has shown that the average cost of installation is about $1.10 per front foot. Los Angeles has installed up to the present time approximately 1,000 ornamental posts, or about ten miles of streets equipped with this method of illumination. The average cost of installation of each post, including the wiring of the post itself, is $107. The posts are installed at an average distance of 130 feet apart. The abutting property owners are required to pay seven-eigths of the cost of illumination, the city paying the remaining one-eighth. About four-fifths of the installation is lighted from one-half hour after sunset until midnight; and one-fifth of the installation, or two posts at each street intersection, is lighted all night, or from one-half hour after sunset to one-half hour before sunrise.

The electric companies supplying the service make the connections from their distribution lines to the posts. In the business part of the city, these connections are, of course, made from underground conduits. Where installations of ornamental posts have been made in the outlying districts, the connections are run from overhead lighting circuits. However, under these circumstances the wires are run down a pipe from the nearest pole and the post is connected underground, so that no wires are visible in making the attachment. The companies are required to maintain the posts to which they are supplying service, the average cost of maintenance being approximately $8 per annum. The amount includes the cost of replacing broken globes, the painting of posts once a year and the labor in connection therewith. All energy required for illumination of the ornamental standards is supplied to the city by the lighting companies at a fixed rate per kilowatt-hour. Originally carbon-filament lamps were used and all installations of lamps and renewals were supplied by the lighting companies. At that time the average cosumption was 672 watts per post. During the past two years these posts have been equipped with tungsten lamps, and the consumption has been reduced to 500 watts for each post. All tungsten lamps for ornamental street lighting are supplied at the expense of the city.

The turning on and off of the ornamental lighting is controlled from the various stations or substations of the lighting companies, each street being connected to a separate circuit and the throwing of a switch turns on all the lights on any street in an instant.

The city of Los Angeles is truly proud of its ornamental street lighting. It has realized the value of this means of illuminating its principal streets, and the residents and property owners in different localities have vied with each other in advocating these installations. A general demand has arisen for more lighting on the public thoroughfares, and there is little doubt that with the approaching advent of a large amount of cheap power in the city and belonging to the city, that Los Angeles will possess the best illuminated and most artistically lighted streets in the United States.



DESIGN OF STANDARD IN HILL STREET, LOS ANGELES.

MINNEAPOLIS, MINN.

During the winter of 1907-1908, several central-station men took up with the officers of the Publicity Club of Minneapolis the question of improved street lighting in the downtown district. This organization is composed of about a thousand leading business

men of the city. During the winter months the club meets at noonday luncheon for one and a half hours twice a month. At each of these luncheons some civic subject is discussed by a speaker. The negotiations with the officers of the club resulted in three representatives of the electric and gas lighting companies being invited to speak at a luncheon in February, 1908. The subjects assigned to these speakers were "What Other Cities Have Accomplished With Forceful Lighting," by R. W. Clark, of the Minneapolis General Electric Company; "Good Street Lighting as a Police Protection," by H. W. Levings, of the Minneapolis Gas Light Company; and "Light as a Medium for Publicity," by H. J. Gille, of the Minneapolis General Electric Company.

THE MINNEAPOLIS ORNAMENTAL POST.

TYPICAL BUSINESS STREET IN MINNEAPOLIS.

At this meeting, which was very enthusiastic, a motion was adopted directing the president of the club to appoint a lighting committee for the purpose of getting as many of the downtown streets illuminated with a uniform system of ornamental street lighting as possible. After various meetings this committee decided on the plan of apportioning the cost on a front-foot basis, part of which (sufficient for the cost of the installation) was designed to be paid by the property owners and the tenants were to pay for the first year's operation and maintenance. This plan met with general approval by the business men of the city. One street after another took up the idea, the result being that to-day about five miles of Minneapolis streets are lighted with this system. This ornamental lighting has attracted visitors from all parts of the country; even foreign visitors have come to see it.

The post adopted in Minneapolis is to-day well known throughout the country, as it has been adopted by a great many cities, and is generally referred to as the Minneapolis post. The original cost was $80 for each cast-iron column, which included all machine work; the original installation cost per column was $60, which included 100-watt tungsten lamps, glassware, wiring, conduits, etc. The cost of the post and installation has been materially reduced since the first installation. The last posts were installed at a cost of $60 for the post and $45 for their installation complete, making a total cost of $105.

At the present time there are 587 posts installed along a little over five miles of street. The posts are placed four in a block on each side of the street, making eight posts in all per block, and they average about ninety feet apart. The four lamps on the side arms burn from dusk to midnight and the top lamp burns all night and every night. The posts were furnished by the Flour City Ornamental Iron Works, of Minneapolis. Electrical energy is supplied by the Minneapolis General Electric Company.

ST. PAUL, MINN.

In the spring of 1906 the merchants along Sixth Street began to talk of "A Way of Light." An improvement association was formed (the Sixth Street Improvement Association), and meetings of property owners and tenants were held from time to time. Officers were elected and committees appointed, the committees being composed of four men to each block. It was the duty of each committee to canvass its block and induce the property owners and tenants to subscribe to the scheme; the property owners were to buy and install the posts, the tenants to pay for the current.

The first posts were installed in the fall of 1906, forty-four in all from St. Peter to Jackson Streets. They were lighted December 16, the event being celebrated by a carnival lasting three evenings. The installation proved immensely popular from the start.

The system has been steadily extended until now there are 318 ornamental posts on eleven different streets or forty city blocks in the heart of the business district. At the present time fifteen more blocks are being canvassed.

During the first part of 1908, the City Council passed a resolution to take over the new system block by block one year after its installation.

During holiday season and on festive

occasions, festoons are draped from each pair of posts. These festoons are made up of thirty-six eight candlepower carbon lamps with a metal circle in the center outlined by sixteen eight-candlepower lamps. Permanent connections have been placed on all the posts to provide for the festoons. The cost of hanging and removing the festoons and of current for them is paid for by the tenants of the streets upon which they are placed.

The foundry work for the ornamental posts amounts to about $55. The arms are cast separate and the latest posts are made in two sections. Most of the posts were furnished by local foundries. The installation of the complete equipment costs from $50 to $65 per post.

TYPICAL LIGHTING OF BUSINESS STREETS IN ST. PAUL.

The lamp equipment consists of one twenty-inch opal globe with a 150-watt tungsten lamp, and four twelve-inch opal globes with sixty-watt tungsten lamps hanging pendent from the four arms. The 150-watt top lamp burns all night, or 4,000 hours per year; the four sixty-watt lamps burn until midnight only. When the festoons are connected, they too are turned off at midnight.

The setting is in the areaway walls just inside the curbing, the filling being of concrete. Electrical connections are run from where the company's service ends through the basement or areaway in conduit to and up the post. Plug fuses are installed in the base of the posts, access being gained through a door on the property side. Two snap switches are mounted on the same block but above the cut-outs, one switch to control the four pendent lamps, the other for the top lamp. The switch for the festoons is placed to one side or below the cut-outs. It is necessary, however, to open the door only to turn on the festoons, as the switches for the regular lights have a rod attached in place of the usual button; this is extended through the base just over the door and operated with a socket key. The Electric Department of the St. Paul Gas Light Company supplies the current for all this decorative street lighting.

MILWAUKEE, WIS.

The conception of the idea of an ornamental street lighting system for Milwaukee originated about the same time with O. M. Rau, superintendent of electric lighting of the Milwaukee Electric Railway & Light Company, and H. E. Franke, a dealer in gas and electric fixtures of Milwaukee.

The proposition was presented to the downtown merchants and they were solicited to become subscribers for the ornamental electric illumination of certain streets under a two-year contract, the cost to be borne proportionately by each subscriber, according to the street frontage of the premises occupied, or to pay outright for the installation of the posts.

Frank C. Courtnay, a prominent real-estate agent, controlling a large amount of downtown property, one of Milwaukee's most progressive citizens, devoted much of his time and energy to the movement and was an important factor in its success.

In many instances, the ornamental posts were purchased outright by individuals, sometimes by tenants, sometimes by property owners; in other instances the posts were rented by individuals and installed in front of their places of business. The cases thus cited were independent of the movement to light certain streets on the basis of an assessment per front foot per month.

The majority of the posts installed are of what is known as the Corinthian type, equipped with five 100-watt Mazda lamps burning in an upright position. These posts were furnished by the Flour City Ornamental Iron Works, of Minneapolis. There are a limited number of Jandus posts installed, also equipped with five 100-watt Mazda lamps, the center lamp burning in an upright position, the other four in a pendent position. These Jandus posts were furnished by the Adams-Bagnall Electric Company, of Cleveland, and were sold outright by Mr. Franke.

The Corinthian posts installed, complete, with lamps, globes, and underground wiring for electric service, are sold for $125 each. They are also put out on a rental basis, under a two-year contract, at $9 per month per post. This price includes the cost of electric service from dusk to midnight, the turning on and off of same, lamp and globe renewals, cleaning globes at least once a month and painting posts at least once a year.

The number of Corinthian posts installed or contracted for, is 113. The distance between posts, where certain streets are illuminated on a front-foot assessment basis, is usually fifty feet.

There were only a limited number of the Corinthian posts sold, the rental basis of $9 per month per post being by far the preferable arrangement, in so far as the merchants were concerned, as they were not obliged to make any investment, and all merchants were on an equal footing as to expense, namely, the street-frontage basis.

The rental proposition made it unnecessary to interest property owners in the scheme; the feeling amongst the property owners was, generally, that the tenants and not the owners should

pay the expense. The city authorities took no part in the movement whatever.

In some of the outlying business districts, a limited number of gooseneck posts with overhead wiring were installed at a cost of $25 each. These posts were equipped with an arc lamp. Some of these gooseneck posts, thus installed, were paid for by the property owners, the tenants paying for the cost of operating the lamps.

DAVENPORT, IOWA.

During the summer of 1907 it was decided to improve the illumination of a portion of the business district of Davenport, which was already fairly well lighted at each intersection with one four-ampere magnetite arc lamp. As a result, the Peoples Light Company, which undertook the campaign, chose a block that had been recently rebuilt and had previously been unpopular.

EAST WATER STREET, MILWAUKEE.

Active solicitation of the merchants was begun and a scheme of lighting was proposed, consisting of sixteen iron posts, eight on each side of the street. Each post was equipped with a fourteen-inch ball and one 100-watt tungsten lamp, suspended from a weak spring made fast through a one-eighth-inch hole through the top of the glass ball. This idea was found to be superfluous in a short time, as the breakage due to shocks with the lamp screwed to a socket made fast to the post was not appreciable. These posts were eight feet high. The expense of this installation was borne by the property owners, and the cost of operation and maintenance by the merchants, each paying his pro rata share based on the foot frontage.

The benefit of this illumination was easily seen and appreciated by many, and during the following season the Peoples Light Company was successful in installing a large number of five-light posts, each twelve feet high and equipped with four ten-inch balls and one 16-inch ball, four 60-watt lamps and one 100-watt lamp, all turned upward. These posts were spaced about forty-three feet apart on each side of the street, and as nearly opposite as possible.

Since these posts were installed, this style of post has been adopted by the city as a standard for all north and south streets, and the same post with lamps pointing downward on east and west streets.

At the present time there are in operation 112 five-light posts which are lighted from the sign circuit, turned on at dusk and off at 10 p. m. each night except Saturday, when they remain burning until 11 p. m. Thirty-two posts are to be installed within the very near future, contracts having already been let for half of this number.

The charge on this class of business is $3 per post per month with a discount of ten per cent if paid by the tenth of the month following that in which the current is used. All installations are now being made with lead-covered cable laid in the sidewalk close along the curb and grouted in when completed. The total cost of the complete system ready to operate is $1.95 per front foot. Since the first installation the practice has been to insist upon the merchants organizing themselves into associations, and all dealings are made with the associations and not with individuals. In this way the monthly bill is promptly paid, without trouble, by the secretary of each association as well as any charges for lamps and globes to replace breakages. Maintenance on the posts has amounted to $6 per post per year.

It has been the company's practice to encourage such installations, but in no case does it install the posts. Local contractors do all this work.

KOKOMO, IND.

A demand for more adequate street lighting began to make itself heard in Kokomo, during the past year. This city is a thriving manufacturing community in northern Indiana with a population of over 17,000. The growth and prosperity of the city clearly demanded a modern lighting system. The commercial department of the central-station company heard of the public feeling for improvement in lighting and immediately took up the issue. Under the direction of O. M. Booher, manager of the department, a careful study was made of all recent developments in street lighting, as a result of which the five-light tungsten-cluster

SPECIAL ARC LIGHTING OF OUTLYING BUSINESS STREETS IN MILWAUKEE.

system was selected as most suitable for the case in hand.

An active campaign was then undertaken, first by calling on the most progressive merchant in each block to unfold the scheme of decorative lighting, point out its advantages and to secure his co-operation. The interest and support of these merchants was readily

BRADY STREET, DAVENPORT.

obtained, in fact, each one became an active worker among the other merchants in his block and helped materially in arousing enthusiasm for the scheme. The cost of the installation was met in an ingenious manner. The merchants were willing to pay for the

MAIN STREET, KOKOMO.

initial cost of the installation, since they realized they would obtain its immediate benefits. As the public feeling in behalf of the plan was very strong, the City Council expressed its willingness to pay for the public benefits by unanimously passing an ordinance in which the city agreed to pay for the maintenance and operation of the system for a period of five years after the merchants had paid for the equipment. Thus the central station was assured of a steady income from the service. For the initial installation complete the charge to the merchants was $1.15 per front foot. The monthly charge to the city for maintenance and operation was $4.05 per post. The service is supplied by the Electrical Department of the Kokomo, Marion & Western Traction Company.

A good idea of the character of the standards selected is obtained from the accompanying view. The standards are of cast and pressed steel and were supplied by the Adams-Bagnall Electric Company, of Cleveland. They present a very attractive appearance. The upper globe is sixteen inches in diameter and contains a 100-watt tungsten lamp, which burns from dusk to dawn every night. The side lamps are each 60-watt tungstens in twelve-inch diffusing globes; these lamps burn from dusk till eleven o'clock each evening. The service is from a three-core, lead-covered, steel-armored cable laid along the curb a few inches below the pavement. Two switches, one for the side lamps and one for the top lamp, control each side of each block; these switches are placed at the alley entrances in the middle of each block and are operated by the night patrolman.

The standards are placed about eighty-five feet apart on each side of the street and as nearly as possible directly opposite each other. The present installation consists of forty-two standards. The popularity of the system is shown the fact that contracts for four additional blocks have been concluded and still further extensions are contemplated.

MISHAWAKA, IND.

Early in the year 1909 the business men's association of Mishawaka, together with the city authorities of this enterprising manufacturing community of 12,000, began to consider the installation of a modern lighting system. A former citizen of Aurora, Ill., called their attention to the ornamental lighting in that city. The president of the association and the superintendent of the city water and electric plant paid a visit to Aurora and were impressed with its street lighting. A meeting of the association was called on their return and at this it was decided to proceed at once with the installation of a decorative lighting system on the principal business streets.

M. V. Cheesman, a local contractor, from a spirit of patriotism undertook the complete contract at the exceptionally low price of $1.07 a front foot. The manufacture of the posts was sublet to the Dodge Manufacturing Company, of Mishawaka. The posts are made chiefly of wrought-iron pipe with cast-iron fittings and ornamental scrolls under the curved side arms. At street intersections all the corner posts have four side arms; the intermediate posts have two arms.

The abutting property owners or tenants were assessed $1.07 a front foot and as a rule responded promptly in their payments. Where some of them refused to pay, the deficit was made up by a second assessment and by popular subscription from such individuals and manufacturers as could be induced to subscribe. The work was rapidly carried out. On the evening of July 5, 1909, the current was switched

on and the whole installation was presented to the city to become the property of the municipality.

On paved streets a trench was cut just outside the curb, about six inches square in section. This was filled with concrete in which was laid a two-inch iron pipe containing the rubber-covered supply wires. Bent risers were run up into the base of each post high enough to prevent any water from running into the pipe. The posts are all flange based and when set on cement walk they were held in place by four anchor bolts grouted into the cement; grouting was also used under the base to seal out the water. When the walk did not come to the curb, a concrete base was built for the post and the conduit pipe placed inside the curb, the pipe being laid in concrete as before. The posts were spaced fifty feet apart and directly opposite each other on both sides of the street.

At first 100-watt tungsten lamps were placed in the top globe and 60-watt pendent lamps in the side globes. This practice was gradually changed until now 40-watt tungsten wire-type lamps are used in all sockets, except in the posts near railroad crossings, where Gem lamps are used. The top globes are twelve inches in diameter and the side globes are ten-inch Alba type with a six-inch holders made of cast iron. There have been installed 152 posts carrying a total of 535 lamps. The total cost of maintenance and current for the year 1910 was approximately $1,500. This included the replacing of some of the rubber-covered wire with lead-covered cable.

The current for the ornamental lighting is supplied from the Mishawaka City Water and Electric Plant, which ran its service wires to the switches mounted on poles at convenient corners. These switches are of the double-pole cartridge-fuse type and were placed in iron boxes. E. F. Crabill, superintendent of the plant, has drawn some interesting conclusions as the result of his two-years' experience with the installation.

Unless the work is very carefully done, he would not advise the use of rubber-covered wire laid in iron pipe. He believes that instead of cutting a slot in the pavement, if a subcurb were built, it would be a much-longer-lived proposition, as moisture will undoubtedly get into the pipe through the concrete and cause more or less trouble with the rubber-covered wire. When trouble develops now, he substitutes lead-covered cable for the rubber. The cost of installing a similar system, with posts spaced fifty feet, will be something like $1.40 to $1.45 per foot from the contractor's standpoint, although it could probably be done at an actual cost of a $1.20 per foot.

WARREN, OHIO.

Sometime before the expiration of the Warren street-lighting contract, then held by the Warren Water & Light Company, the lamp factories in the city (of which there are three very large ones), commenced to agitate the use of Mazda lamps for street lighting. Somewhat later the National Electric Lamp Company, of Cleveland, installed one circuit to demonstrate the suitability and efficiency of these lamps, the standards being furnished by the Union Metal Manufacturing Company, of Canton, Ohio, and four different kinds of reflectors being furnished by different manufacturers. This installation comprised twenty-four lamps and was installed March 20, 1909.

STEEL STANDARD, KOKOMO.

The lighting company, seeing that the cost of using iron standards throughout the whole city was going to be too expensive for the city to finance, advised for the residence streets a pole bracket with radial type shade, the brackets to be attached to the wooden electric poles then installed. This installation comprised twenty 100-watt lamps and was completed May 7, of the same year. Much discussion then ensued and several small contracts were written up without any satisfactory complete understanding, until November, 1910, when the general contract was finally awarded to the Warren Water & Light Company, which was a competitive bidder to the Hydro-Electric & Gas Company.

This contract called for some 835 lamps of sizes ranging from forty to eighty candlepower. Installation was made to consist of three series circuits, two circuits comprising the residence portion of the city and wired overhead, the third circuit covering the business section and wired underground. Most of the downtown lighting is with three-light ornamental posts. The underground system was wired in two sub-circuits, so that about one-half of the lamps are cut off at midnight, while the balance of that circuit, together with the other two circuits, burn on an all-night and every-night schedule. The first circuit under this new contract was turned on May 24, 1911, the second circuit June 7, and the third circuit August 15. All of the street arc lamps have now been done away with and the new tungsten lighting is proving very satisfactory to the citizens.

The lighting company, now under the name of the Trumbull Public Service Company, which is the successor to the Warren Water & Light Company and the Hydro-Electric & Gas Company, considers itself justified in saying that this lighting system is the best one for street lighting that there is available at the present time. Some additional facts and several illustrations of the Warren street lights were given in these columns in the issue of July 2, 1911.

FORT ATKINSON, WIS.

With the advent of the ornamental street-lighting systems in the large cities comes the demand for a similar class of illumination in the small cities of less than 10,000 population. It is seldom that either the electric com-

pany or the citizens of these smaller towns feel able to invest much money in installations of this character. The elaborate poles and equipment costing upwards of $75 per pole installed are out of the question and it has become necessary to develop a system costing considerably less, but still maintaining the artistic and useful effects.

The problem has been nicely worked out at Fort Atkinson, Wis., a thriving city of 4,000 inhabitants, in connection with the municipally owned lighting plant.

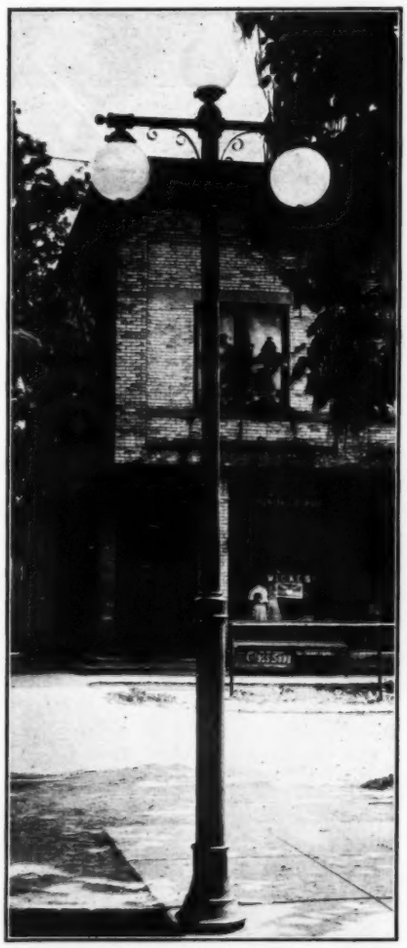
Thirty-eight ornamental poles are installed in the business district. The remainder of the city is lighted by a multiple incandescent system. The poles are made of steel and cast iron. Each carries three sixty-watt Mazda lamps in ten-inch Alba globes, two of the globes hanging down and one pointing upwards. The poles are spaced on an average from 90 to 100 feet apart. They are simple in design, all superfluous beads and flutings being eliminated. Their constructional feature is the specially designed globe-holder which holds the globe at all points around the periphery of the opening thus reducing breakage to a minimum. These globe-holders are both water and insect proof.

The poles are set opposite each other and as near in line as possible. Each pole is secured to the sidewalk by removing part of the concrete and building in a new concrete block to hold the foundation bolts. The body of the pole does not extend below the surface of the ground but is screwed to the base flange which is bolted to the sidewalk.

The wires for the system are drawn into Sherarduct laid about one foot underground just outside of the stone gutter. Three wires are used, one to control the side lights, one to control the top lights and the third a common return for both top and side lights. All poles are lighted from one 7.5-kilowatt transformer located centrally. The farthest pole is 1,000 feet from the transformer, but no serious drop in voltage is noticeable. The lights are not controlled at the power house by a primary switch but are turned on and off at the transformer by the night watchman. All lights are burned till twelve o'clock and the top lights only are left on all night.

The total length of the street lighted is about 1,600 feet. There are 114 sixty-watt lamps in all, consuming about 6,840 watts. The illumination is satisfactory and the poles make a very attractive appearance by day as well as by night. The special feature of this pole is that it combines beauty and utility with extremely low cost—$24 complete, including receptacles, globes, lamps and wiring. On account of its comparatively short length (12.5 feet), good illumination is secured under the trees.

The effect of installing the system



THREE-LIGHT STANDARD, FT. ATKINSON.

in the city was remarkable. When the lights were turned on, the most violent knocker was immediately turned into a booster. The City Council passed ordinances to remove all overhead wires, signs (including electric signs), hitching posts and all manner of obstructions. The streets were cleaned and the sidewalks swept. Strangers are now loud in their praises of the town and take pains to advertise it in other towns. Several citizens have already ordered poles installed in front of their residences at their own expense. In one case a whole street in the residence district met the expenses of extending the system to its locality.

It is surprising to note the small cost of lamp renewals. In about three months of operation there have been ten lamps and no globes replaced. At least four of the lamps were defective and never burned at all.

The whole cost of the system was met out of the earnings of the plant. The poles were designed by H. G. D. Nutting, manager of the plant and built in Fort Atkinson under his direction. A feature of the installation work was the ditching for the conduit. The pavement in Fort Atkinson is chiefly macadam with cobblestone gutters. The roads were broken to nearly the full depth of the trenches by means of a heavy breaking plow drawn by a steam roller. By the use of narrow spades the trenches could then be quickly cleaned out by hand. The Sherarduct was then laid and the wires pulled in.

ALRERT LEA, MINN.

During the winter of 1908 the City Council of Albert Lea started to consider plans for paving some of the business streets. Until that time there had been no paving in this city of 6,000 inhabitants. Ludwig Kemper, manager of the Albert Lea Light & Power Company, at once began to talk curb lighting to the different merchants along the streets to be paved. The plan proposed was along the lines of those used in Minneapolis and St. Paul. Whereas most of the merchants were in favor of installing a curb-lighting system, they did not feel inclined to finance the proposition, both as to first cost and cost of operation. After several months of agitating the proposition, this original scheme was dropped and the matter taken up with the City Council with a view of having the municipality contract for an installation. At the same time a few sample posts were installed, and this aided considerably in arousing interest in the proposition.

Finally a five-year contract was entered into with the city to install fifty-two three-light posts on Broadway and Clark Street, which are the main business streets of the city. The Albert Lea Light & Power Company financed the installation and the city paid the cost of operation and maintenance. The posts carry two 60-watt and one 40-watt tungsten lamps, one 60-watt lamp burns all night and the

other lamps only until midnight. This installation was put in operation in November, 1909.

During the summer of 1910 more streets were paved and a proposition was made to the council to equip Main Street, a residence street connecting two railroad stations, with seventy-seven one-light posts equipped with sixty-watt tungsten lamps, the lamps to burn all night. This was accepted.

The three-light posts used are Cutter's Suburban-type posts, supplied by the George Cutter Company, of South Bend, Ind., the one-light posts were supplied by the Metropolitan Engineering Company, of New York. At the present time thirty additional one-light posts are being installed on another residence street. All posts are spaced about eighty-nine feet apart. When this new installation is completed, it will make a total of fifty-two three-light and 107 one-light posts, which, considering the size of the city, is an exceptionally fine showing.

DAY VIEW OF A BUSINESS STREET, ALBERT LEA, MINN.

The cost of installation of the three-light posts is about $60 per post, exclusive of taking up and relaying of sidewalks, as these posts were put in at a time when the sidewalks were rebuilt. The posts alone, with glassware and lamps, cost $35 installed, leaving $25 for underground construction. The cost of installation of the one-light posts is about $50 per post, of which $30 was the cost of the post inclusive of glassware and lamps.

The city pays $40.59 per annum per three-light post, and $24.50 per annum per one-light post. After allowing fifteen per cent per annum for interest and depreciation, and after paying for switching, maintenance and lamp renewals, this nets the company six cents per kilowatt-hour, which, considering the annual load-factor of 36.5 per cent, is quite satisfactory.

Water-Power Development in Austria-Hungary.

At present there is considerable interest being manifested in the further development of water power in Austria-Hungary.

In Hungary and Croatia there are two large projects under consideration concerning the final development of water power. One of these projects was outlined by the firm of Albert Buss & Company, of Basel, Switzerland, and is now under consideration by the Hungarian Ministry of Agriculture. According to this project, it is contemplated to utilize the water power of the Danube on the Presburg-Raab section.

The plan comprises the construction of a canal which will equally serve the interests of navigation and irrigation. In the cities of Pressburg, Wieselburg, and Raab are to be built three reservoir embankments, by which it will be possible to produce electrical energy exceeding 40,000 horsepower, which will be partly used for lighting those cities. Aside from this, the industrial establishment in the neighborhood can be supplied with electric power. The cost of these plants is estimated at $8,120,000.

NIGHT VIEW OF A BUSINESS STREET IN ALBERT LEA.

A second project, for the accomplishment of which French capitalists are interested, concerns the final development of the existing water power in the town of Zengg in Croatia. After completing the building of all locks the power obtained will be 60,000 to 80,000 horsepower. This power is to be furnished to the city of Fiume and to the whole Croatian and Austrian seacoast in that neighborhood.

It is further proposed by the management of the Hungarian Government Railways that power be furnished them for operating the railways from Fiume to Croatia by electricity. The cost of building and completing this plant is estimated at $14,210,000 to $16,240,000. This project has so far progressed that exhaustive negotiations are already being made with those parties who might likely use electric power.

Copper on Hand Decreased.

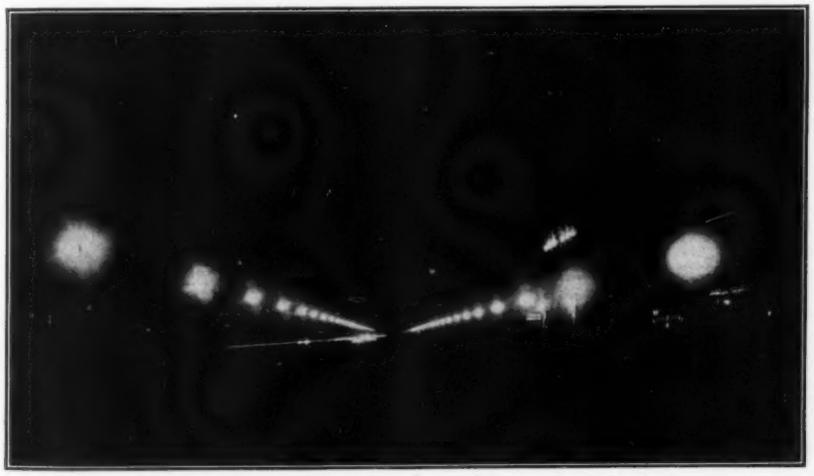
Stocks of copper in the United States at the end of August totaled 133,441,501 pounds, according to the figures compiled by the Copper Producers' Association. This is a shrinkage of 4,297,357 pounds since July, and is the lowest point since last year.

NIGHT VIEW OF A RESIDENCE STREET IN ALBERT LEA.

Tungsten Lighting Installation on Michigan Boulevard, Chicago, Completed.

There has now been practically completed what is believed to be the finest installation of ornamental tungsten-cluster street lighting in this or any other country, and it is significant that this installation has been made under the direction of and is to be operated and maintained by, a municipal body. It is the lighting of Michigan Boulevard, Chicago, between Randolph and Twelfth Streets, a stretch of nearly one and one-sixth miles. In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of December 3, 1910, the main features of this installation, together with an illustration of the standard selected, were first made public.

DAY VIEW OF MICHIGAN BOULEVARD, LOOKING NORTH FROM PARK ROW.



NIGHT VIEW OF MICHIGAN BOULEVARD, LOOKING SOUTH FROM HARRISON STREET.

The accompanying views give a better idea of the completed installation, although unfortunately the photographs were taken during rainy weather and therefore fail to do justice to its elegance both by day and night. On the east side of the boulevard is Grant Park, which is Chicago's central lake-front park; along the west side of the boulevard are many of the city's most imposing hotels, theaters, clubs and office buildings. The width of the newly widened roadway is seventy-five feet; the sidewalks are twenty-five and thirty feet wide.

For the new curb lighting a total of 160 standards have been installed. They are placed nearly seventy-five feet apart along each curb and directly opposite each other. The standards are of a distinctive and rich Renaissance design with six highly ornate arms, each holding a 100-watt Mazda lamp with its center fifteen and one-half feet above the sidewalk level. Each lamp is inclosed in a twelve-inch Alba diffusing globe. The full height of the standard is 19.5 feet.

The lamps are supplied in multiple from 115-volt sixty-cycle underground circuits. Those on the west side of the boulevard are placed in vitrified-clay conduit just inside the curb and under the sidewalk; on the east side of the boulevard the conduit was placed in the parkway at the east edge of the twenty-five-foot concrete walk, so as to avoid breaking into the latter, since it had been laid before the type of lighting system had been adopted. The east standards were connected with the conduit by driving an iron pipe under the sidewalk by means of an improvised battering ram.

For the convenience of pedestrians crossing through the dense automobile traffic of the boulevard, sixteen safety islands have been erected in the middle of the roadway at the most dangerous crossings. On each island is a richly ornamented standard supporting a group of three sixty-watt carbon-filament lamps inclosed in a twenty-inch ruby glass globe.

VIEW ACROSS MICHIGAN BOULEVARD, LOOKING TOWARD GRANT PARK.

The cost of the installation was borne partly by the property owners on the west side of the boulevard in connection with a special assessment for widening and repaving. All this work was done by direction of the South Park Commission, which has jurisdiction over the parks and boulevards of the South Side. Electrical energy comes from the South Park substation and is supplied by the Sanitary District of Chicago.

ELECTRIC SIGN LIGHTING.

TYPICAL EXAMPLES IN CHICAGO.

The very remarkable development of the business of electric signs within the last few years has been, in itself, not only most noticeable, but has led to a wide study and more general understanding of its purposes and possibilities. Twelve years ago Chicago contained perhaps a score of electric signs; at the last official count (May 1911) there were 5,750 electric signs on the circuits of the Commonwealth Edison Company, representing a total connected load of approximately 3,500 kilowatts. In probably no other city in the country are the signs so well distributed as in Chicago. While there are naturally a considerable number of large and spectacular displays, the bulk of the sign business is among merchants of moderate means who consider an electric sign the first evidence of progressiveness.

FIG. 1.—TYPICAL PANEL SIGN.

FIG. 2.—GROUP OF SIGNS ON MADISON STREET.

The advertising value of an electric sign is, of course, proportional to the number of people who read it as compared with its cost of maintenance. It must be so placed as to attract the largest number of gazers possible. An illuminated sign attracts and compels attention in direct proportion with its brilliance, intensity and size, its remoteness from other light sources and the number of moving elements it may contain. The essentials for a good sign are first, that it should be carefully and simply constructed, using only the best material; second, that it should be erected in such a way as to be absolutely safe; and third, that it should conform both in size and architecture to the surrounding buildings.

Tungsten and carbon lamps are the two kinds of sign lamps used today. Until recent months the carbon lamp has been most commonly used, the tungsten being comparatively new. The latter, however, possesses several advantages, the most important being the increased efficiency, which is due largely to the temperature at which the tungsten operates; furthermore the decrease in candlepower of the tungsten lamp is very small, the drop being from 10 to 15 per cent during the entire life of 2,000 hours thereby insuring a uniform quality of light at all times. These advantages are becoming more generally recognized with the result that sign lightning is rapidly reaching fields heretofore unapproachable.

The introduction of these low-voltage tungsten lamps has necessitated changes in the method of wiring, as the carbon sign lamps are practically all wired in multiple. In order to use these lamps on standard lighting circuits it is necessary to reduce the voltage. When wiring for use on alternating current, special low-voltage transformers are used. These are usually wound to give a ten-to-one ratio of transformation and the lamps connected directly to the secondary leads. To avoid the no-load losses, the switches are introduced on the primary side. Where there are but two or three circuits to be handled, flashers, when used, may also be located on the higher-voltage leads. Good transformation, even as small as one-third kilowatt, show an efficiency at full load as high as ninety-two per cent and a regulation of about two per cent. An allowance of voltage drops in the windings is made in the construction, so that normal voltage is obtained at full load.

Tungsten sign lamps may be used on direct-current circuits by connecting in series multiple. The burning out of one lamp extinguishes that lamp only, although the current through the other lamps is thereby somewhat increased. In order to make this increase in current small, the number of lamps in parallel should be as large as possible. In order to obtain the best results a series-multiple sign should contain from 100 to 150 lamps. In any case the burnouts should, of course, be replaced promptly.

Where the total number of lamps is small it is necessary to connect independent series circuits across the line. The number of lamps in series is determined by their voltage and the voltage of the mains. The objection to this

method is due to the fact that when one lamp burns out the entire series has cut out the circuit. It has the advantage, however, of necessitating prompt renewals.

Regarding flashers, it is claimed that the saving effected by putting lamps in motion in a spectacular sign varies from 30 to 50 per cent. A fireworks display, for instance, consumes only about thirty-one per cent of current as compared with the same lamps burning steadily. Clouds of steam, smoke, fire, water effects, traveling boarders and similar high-speed work save about twenty-eight per cent.

The simplest form of flashing device is doubtless the thermo-flasher. In such a mechanism an expansion member is heated by the passage of the current and its change in length or form is made to open the circuit. On cooling, contact is made, again completing the circuit and the cycle repeats itself. Flashers designed for controlling a single lamp are made in very compact form, similar in appearance to an adapter. Some of the larger thermo-flashers are provided with a quick-break device, which in connection with platinum contacts gives them a long life. The relative intervals on and off may be adjusted, but it is of course hardly possible to maintain a desired sequence of operation in flashing several circuits.

Where there is a small number of heavy-current circuits, motor-driven double-pole flashers are used, while for spelling out words a single-pole switch for each letter is usually employed.

FIG. 4.—ROBERT BURNS SIGN.

Special forms of drum flashers are needed for the novelty effects such as crawling snakes, revolving wheels, galloping horses, etc. Such flashers are all motor driven.

In Chicago the development of the electric-sign business may well be taken as a barometer of the aggressiveness of the local central-station management. In this department as well as in all other branches of central-station activity, the Commonwealth Edison Company has assumed a broad-minded and far-sighted policy. A well organized sign department, consisting of eight business getters, carries on a continuous, systematic campaign and the results are shown by the fact that the number of electric signs in the city increases a considerable number each month, in spite of the fact that the territory has been comparatively well covered.

As previously mentioned the bulk of the 5,750 signs in Chicago are contracted for by the merchants of moderate means and of the total number approximately 4,000 are burning on a rental basis. This condition is due to the sign rates made by the company. On contracts running for a period of two years or more the company furnishes, installs and maintains an electric panel sign of standard blue-enamel type, at rates ranging from $4.50 per sign per month to $14.00 per sign per month. The lower rate is for signs containing twelve four-candlepower lamps, while the higher rate applies to signs containing sixty-four four-candlepower lamps. These rates are based on a current consumption of an equivalent of ninety hours' use per month per sign, all current in excess of this being charged for at the rate of six cents per kilowatt-hour. For sectional signs, of standard make, the Edison company furnishes, installs and maintains them at a rate of fifteen cents per socket for two-candlepower

FIG. 3.—FIRST SPECTACULAR SIGN IN CHICAGO.

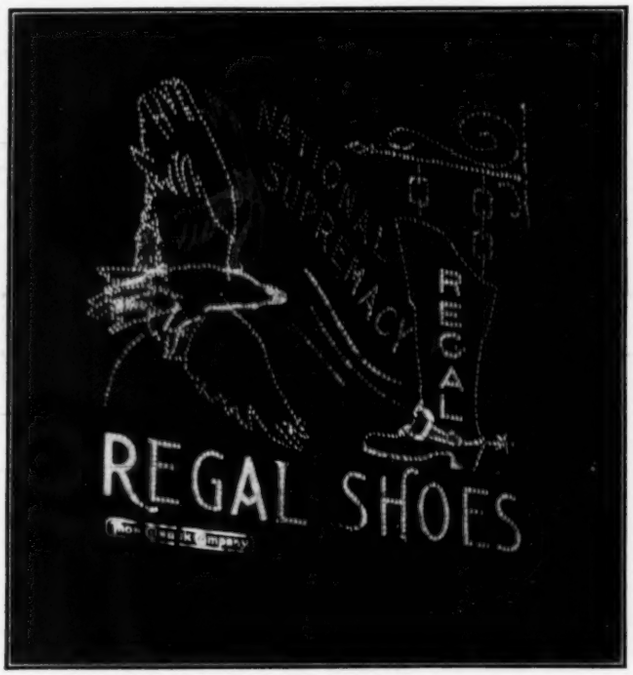


FIG. 4.—ONE OF THE NEW SPECTACULAR SIGNS.

lamps and nienteen cents per socket for four-candlepower lamps. This rate is also based on a current consumption of an equivalent of ninety hours' use per month with a charge of six cents per kilowatt-hour for all excess current. In addition to these two methods of charging the company maintains a system of rates without overtime charged, based on definite schedules of burning time. Rates of the latter character are only offered in districts where a sign patrols are maintained for switching on and off the current. All of the rates abovementioned take no account of whether or not flashes are used.

One of the most notable advances in sign lighting since these lamps have been available has been in roof signs. The brilliant white light of the tungsten lamp and the ability of the light rays to penetrate smoke and fog has made available space for roof signs that heretofore was of no advertising value. This is admirably demonstrated by glancing at the signs along the right-of-ways of the elevated, steam and street railways in Chicago. Many signs are located on buildings, hidden from the view of pedestrians, at such a distance from the path of trains that with the old carbon lamp, the advertising effect would be entirely lost while with tungsten lamps they are easily readable.

As an indication of the impetus that has been given the electric-sign business attention is called to the accompanying illustrations of typical installations. Fig. 1 shows the standard type of panel sign as furnished by the Edison Company, while Fig. 2 is a view of Madison Street at night.

The Gold Seal Champaign sign, shown in Fig. 3, was the first spectacular electric sign erected in Chicago. This was put in operation on December 15, 1908. This sign is fifty-five feet high by forty-two feet wide. It originally contained 1,755 four-candlepower carbon lamps. It was on display in Chicago for nine months and was then taken down and moved by the Thomas Cusack Company to a location in Buffalo, N. Y., at which place it was kept on display for a period of one year. After this time it was again moved back to Chicago where it is now on display at 146 State Street. The last time it was moved back to Chicago the lamps in the reading matter were changed to tungsten lamps. The sign flashes as follows: The lamps in the reef and the grapes are steadily burning. The words "Gold Seal" are flashed on together, which is followed by the word "Champaign."

The Robert Burns electric sign (Fig. 4) is located at the junction of Cottage Grove, Drexel and Oakwoods Boulevards, in probably the best sign location outside the loop district in Chicago. This sign is 25 feet wide by 32 feet high. It shows a man holding a lighted cigar in his hand and the flashing of the sign shows the smoke traveling from the end of the cigar. In addition to the flashing of the smoke the words "Robert Burns Ten Cent Cigar" is flashed on one line after the other. This sign contains approximately 1,150 four-candlepower tungsten lamps and is used on alternating current with transformers.

The Regal Shoe sign, shown in Fig. 5, is on display at the southeast corner of State Street and Jackson Boulevard. This sign is 45 feet wide by 55 feet

FIG. 6.—RINGLING CIRCUS SIGN.

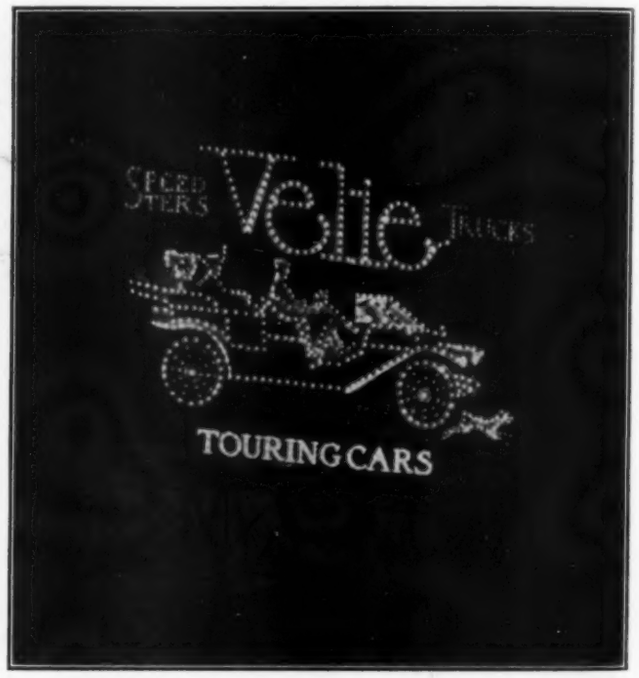


FIG. 7.—DOUBLE-FACE SIGN.

The advent of the tungsten sign lamps, while not revolutionizing sign lighting, has had a parteiularly encouraging effect on the development of sign business in Chicago. The history of its introduction has been somewhat similar to that of the tungsten-filament lamp for ordinary lighting. At first the high first cost of the lamps retarded their general application, but their inherent advantages over the carbon lamp were soon recognized. One of the largest manufacturers of electric signs states that since the introduction of the tungsten lamp the regular yearly increase in sign manufacture has increased over twenty-five per cent and fully fifty per cent of all signs made are wired for tungstens.

high, and contains 2,250 four-candlepower carbon lamps. This entire sign is a steady burning sign with the exception of the eagle, which is operated to show an eagle in flight.

The Ringling Circus sign was a temporary one located at 308 State Street. This sign was 32 feet in width and 42 feet in height. It shows a ballet girl on horseback with the horse traveling

FIG. 8.

at a high rate of speed. The reading matter in the sign was burned steadily. This sign was equipped throughout with twelve-candlepower tungsten-filament lamps, and the sign contained approximately 1,450 lamps.

In Fig. 7 is shown the Velie automobile sign situated on the roof of a building at 1615 Michigan Avenue. This is an all-tungsten double-face sign, showing two ways. One side faces north

FIG. 9.

and one side faces south. The entire sign contains approximately 3,000 four-candlepower lamps. The frame upon which this sign is placed is 62 feet in height and 30 feet in width, and the lower part of the sign proper is elevated 32 feet above the roof. This sign has probably the greatest amount of action for a sign wired on direct current and equipped with twelve-volt tungsten lamps. The flashing of the sign shows an automobile traveling at a high rate of speed, showing the veil of the woman sitting in the tonneau of the car being blown by the wind. All the color effects in this entire sign are secured by the use of natural-color lamps.

FIG. 10.

Runkel's Cocoa electric sign, shown in Fig. 8, is located at the northwest corner of State and Lake Streets and is visible down Lake Street a distance of six blocks. This sign shows a cup of cocoa with the steam coming out of the cup. The steam action in the sign is continuous, while the reading matter,

FIG. 11.

"Runkel's Cocoa," is flashed on and off, one word after another. This sign contains approximately 1,650 four-candle-power lamps.

In Fig. 9 is shown the Siegel Cooper sign situated on the roof of this store.

FIG. 12.

This sign is 55 feet in width by 65 feet in height, and shows an airship in flight. It contains approximately 1,800 four-candlepower lamps, both standard base and candelabra. The Kellogg sign, shown in Fig. 10, is another large spectacular sign which has attracted considerable attention. It contains 1,700 lamps and is 60 feet wide by 50 feet high.

The W. K. Kellogg Toasted Corn Flakes electric sign is situated on the building at the northeast corner of Michigan Boulevard and Randolph

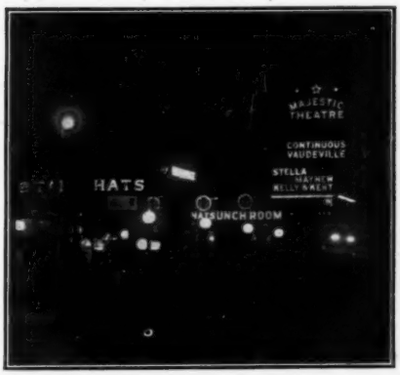


FIG. 13.

Street. This is the second spectacular electric sign erected in Chicago. This sign is flashed along the following lines: A streamer is run down the extreme right-hand side of the sign to the top of the second floor of this five-story building. The lamps in the lower part of this streamer are flashed on first and rapidly climb up to the upper part and clear across the sign to the

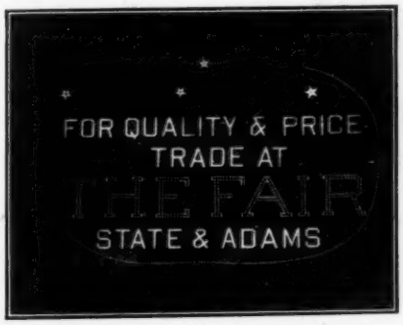


FIG. 14.

letter "W" in the signature. When the lamps reach this part of the sign the streamer goes out and the name W. K. Kellogg is written one lamp after the other. Simultaneously with the writing out of the signature, the reading matter "Toasted Corn Flakes" is flashed all together, which in turn is followed by the catch line "Look for this Signature." The entire sign remains burning for a short time, then all is flashed off together and repeated.

The sign of "The Fair," shown in

Fig. 14, is located on the building at the northeast corner of Michigan and Randolph Streets and shows free and clear across Grant Park and Michigan Boulevard for a distance of one and one-half miles. It is 52 feet high by 76 feet wide and contains 2,200 high-candlepower tungsten lamps. This sign is equipped with the largest flasher ever manufactured to operate an electric sign, the flasher alone being 4 feet high and 14 feet wide.

The Henderson Bourbon electric sign (Fig. 11) is located at the southeast corner of Michigan Avenue and Park Row, showing north to all the travel along Michigan Avenue and Grant Park. This sign is 40 feet high by 50 feet wide and same contains 2,750 two and four-candlepower standard and candelabra-base lamps. This sign shows a figure of a Kentucky colonel standing with an umbrella over his head holding a bottle of bourbon in his hand. It also shows rain falling throughout the entire sign. The tail of the coat of the colonel and the muffler around his neck have the appearance of being blown by the wind. The action in the coat and muffler and the rain is continuous, while the reading matter is flashed one line after another. This is probably one of the most novel signs ever erected in Chicago.

Fig. 15 shows a special type of panel sign installed by the Commonwealth Edison Company in front of the Ruppert shoe store on Van Buren Street near La Salle Street. This sign is made up of individual electric letters which are interchangeable and permit of the wording of the sign being changed as desired. In the particular sign illustrated tungsten-filament lamps are used.

The Speedometer sign shown in Fig. 12 is an interesting electric sign on the roof of a building on Michigan Avenue, which attracts the attention of automobilists and others passing in either direction on that thoroughfare. The sign is double-faced, and represents the dial of a speedometer designed for use on automobiles. The flasher operates the two sides alternately, so that the number of lamps burning at one time is only one-half of the total installed. The indicator of the sign swings across the face of the dial from zero to the highest speed—sixty miles per hour. It is outlined by electric lamps closely set together so that the eye can easily follow its motion over the scale. In the illustration the concentric arcs are the effect upon the photographic plate of the moving pointer.

The Thomas Cusack Company, which has erected the signs described herewith, are using tungsten lamps exclusively in all its new signs. The company has found that these lamps, in addition to effecting a saving in current, are much more suited to the smoky atmosphere of Chicago than the carbon lamps.

New York Subway Offer.

Mayor Gaynor of New York City has under consideration a proposition regarding the solution of that city's subway problem. Financial resources, assuring practically unlimited credit, and put in a concrete amount of $500,000,000, have been placed at the disposition of the city in a plan devised for the construction of subways, now proposed or that may be judged necessary for the public welfare, without undue risk, an indefinitely prolonged period of building, or excessive tax burden to the municipality.

The proposal is entirely independent of the transit companies, either of Manhattan or Brooklyn, which were the competitors in the negotiations before the McAneny Joint City Committee ended by the action of the Board of Estimate at the beginning of July. It has nothing to do with operation, but dealing first and primarily with construction may cover the equipment of the subways that may be built with the funds to be furnished. The sole condition sought by the Committee representing the interests at the back of the offer, subject to legal powers and the constitutional authority of the city, is a fair return on the capital invested, secured by a lien on the property.

FIG. 15.—SPECIAL INTERCHANGEABLE-LETTER SIGN.

Coal Production in Iowa.

The total production of coal in Iowa in 1910 was 7,928,120 short tons, valued at $13,903,913, an increase of 70,358 tons in quantity and of $1,110,285 in value over the figures for the preceding year, according to a statement just issued by E. W. Parker, coal statistician of the United States Geological Survey.

Iowa probably ranks second among the states west of Mississippi River in order of priority as a coal producer. At the census of 1840 Iowa and Missouri were the only states west of the river in which any coal production was reported. Missouri, however, was credited with an output of nearly 10,000 tons, while Iowa's production was given at 400 tons. Iowa's total coal production to the close of 1910 has amounted to nearly 164,500,000 short tons, which, including the estimated loss of half a ton for every ton recovered, represents an exhaustion of approximately 247,000,000 short tons. The original supply of coal in Iowa, as estimated by M. R. Campbell, was 29,160,000,000 short tons, from which it appears that at the close of 1910 over 28,900,000,000 short tons, or a little over ninety-nine per cent of the original supply, was still available.

Street Lighting in Vancouver.

Vancouver, B. C., is to extend its ornamental street lighting. The city pays one-quarter of the maintenance charge and the property owners three-fourths, besides the cost of installation.

FUSING WIRES IN HYDROGEN.

BY A. A. SOMERVILLE.

It is frequently desirable in the manufacture of electrical apparatus to fuse copper lead wires onto some other metal which has a high melting point and may also unite with oxygen readily forming an oxide. A typical case is that of fastening leads to filaments for incandescent lamps. Tungsten, molybdenum and tantalum all have high melting points, also are easily oxidized. They can not be fused readily by any means except the electric arc and if heated even to a red heat or possibly lower in air the metals are quickly transformed into oxides.

Manifestly to handle the metallic filaments successfully they may be heated only in an inert or reducing atmosphere as nitrogen or hydrogen or in a vacuum. For research and general purposes of investigation the writer had occasion to fasten lead wires to various sorts of filaments in order to measure their resistances at high temperatures. Paste for this purpose is not reliable and soldering is not possible. The two metals had to be fused. Copper, nickel or platinum was used for the lead wire. The leads could be fused to the filaments in an oxyhydrogen or oxy-acetylene flame but the filament would no longer be metallic but an oxide instead. They could also be fused in an electric arc but this did not prevent oxidation either.

It was decided that the fusion must take place while the heated part was in an inert gas. Also since an electric arc could be controlled and operated in a small space it was decided to use that as the heating agent. Since it was for laboratory purposes the whole apparatus was very simple and inexpensive. A bottle could easily be filled with hydrogen and the problem then became this—to get the carbon electrodes and the filament and lead wire to be fused inside the bottle and perform the operation of fusing successfully. A tall quart bottle of dark-colored glass was used. The dark-colored glass was admirable as it served as a protecting screen between the arc and the operator's eyes. The bottom was cut out of this bottle by passing a red hot iron around it after it had been scratched with a file. The filament and lead wire could be inserted into the bottle now through the bottom and suspended in a small wooden clamp near the neck or top of the bottle. The bottle would set on a work bench and could be filled with hydrogen from a Kipp generator or a high-pressure tank, introducing the hydrogen through the neck of the bottle which was closed with a rubber stopper containing a single hole to admit a glass tube through which the hydrogen flowed. Since hydrogen is lighter than air the latter is displaced, being expelled at the bottom and the bottle becomes filled with a non-oxidizing gas. In this inclosure the filaments may be fused if the arc can be operated successfully.

The carbons or electrodes had to be introduced into the bottle through the sides of the same. Two holes were bored diametrically opposite each other about midway of the height of the bottle. These holes were started and finished by means of a rat-tail file. They were just large enough to admit half-inch carbons which had been pointed or sharpened in order to produce an arc of small cross-section. Wires from a switchboard were connected to these carbons outside the bottle and the operator could by manipulating the ends outside the bottle produce an arc on the inside.

It was later found that lead pencils served better for electrodes than did ordinary carbons. A lead pencil consists of graphite mixed with clay as a binding agent. This so-called lead will conduct electric current and is not easily melted, so it makes a fine electrode for purposes where a small arc is required. The lead pencil is sharpened at one end. Near the middle a notch is cut in the wood laying the lead bare so that connection can be made there with the switchboard. A piece of rubber tubing about an inch in length may be slipped over the pencil which is now inserted in the hole ground in the side of the bottle and the rubber tubing on the pencil effects a close gas-tight fit between the pencil and glass bottle. The wooden sheath surrounding the lead also serves as an insulator so that the two pencils connected to opposite sides of a 110-volt circuit may be taken one in either hand without inconvenience to the person so doing.

When the tips of the pointed pencils are brought together a small spark is made which can be controlled by the voltage or resistance in the circuit. The tiny arc may be made to play on the tips of the filaments and wires to be fused together until a small bright globule of molten metal is formed when one may be pretty sure that they are securely fused and not the least oxide formed. The amount of metal melted need not be much bigger than a grain of sand.

One has to be careful that the bottle is full of hydrogen and not a mixture of hydrogen and air as such a mixture may be explosive and is set off by an electric spark, but since the explosion is not confined it is not dangerous as the gas can escape at the bottom and the bottle is simply lifted in the air a few feet and not damaged.

A similar method of fusing filaments has been in use in some of the lamp factories.

Rates in San Diego.

The San Diego Consolidated Gas & Electric Company, of San Diego, Cal., has reduced its lighting rates, commencing September 1, about sixteen per cent, and its power rates from eleven to twenty-seven per cent. The new rates are as follows:

LIGHTING.

First 100 kilowatt-hours, 10 cents; next 100 kilowatt-hours, 9 cents; next 100 kilowatt-hours; 8 cents; next 100 kilowatt-hours, 7 cents; next 100 kilowatt-hours, 6 cents; in excess of 500 kilowatt-hours, 5 cents.

Minimum charge of $1.00 per month per meter installed.

POWER.

First 100 kilowatt-hours, 8 cents; next 100 kilowatt-hours, 7 cents; next 100 kilowatt-hours, 6 cents; next 100 kilowatt-hours, 5 cents; next 100 kilowatt-hours, 4 cents; between 500 and 1,000 kilowatt-hours, 3 cents; in excess of 1,000 kilowatt-hours, 2 cents.

Minimum charge of $1.00 per horsepower installed.

Austrian Incandescent-Lamp Trade.

A recent consular report states that the exports of incandescent lamps from Austria-Hungary in 1909 were 565 tons, worth $805,000, while in 1910 they were 725 tons, worth $1,000,000. These exports went to markets over a wide area—Germany, Russia, Italy, India, Roumania, Servia, Egypt, Mexico, Belgium, and the United States.

Large Plant in Brazil.

By a decree of the Brazilian government concessions have been granted to a Rio de Janerio firm for the exploitation of the hydraulic power of the Paulo Alfonso Falls of the River San Francisco.

The contract is for seventy years maximum, and requires a first installation of 200,000 horsepower, increased up to 1,000,000 kilowatts in fifteen years after the inauguration of the first hydroelectric installation.

The Value of an Example in Street Lighting.

A year ago two small cities in northeastern Ohio were suffering from the same disease, chronic gloominess. Today one of them has entirely shaken off the malady, while the other shows signs of convalescence. Perhaps the detailed symptoms of the two cases may prove interesting.

Salem, a place of about 9,000 people, is located in Columbia County, while about twenty-four miles to the north of Salem is Warren, the seat of Trumbull County, a bustling city of nearly 12,000 inhabitants. A year ago the streets of both Salem and Warren were lighted in practically the same manner, open carbon arcs, few and rather far between, being set to "rule the night" during the stated absences of the moon. Only the more thickly populated sections of each town were thus favored.

The larger town, as it happened, was the first to improve its lighting conditions, and did so with a vengeance, discontinuing entirely the use of the ancient open arcs and replacing them by an installation which employs metal-filament incandescents exclusively. To be specific, the new lighting equipment consists of sixty cast-iron fluted columns each having one upright 80-candlepower and two pendant 40-candlepower street series lamps equipped with diffusing globes in the business section; twenty-two single 60-candlepower lamp standards, similarly equipped around the central park; and 620 lamps (355 of 40 candlepower, 90 of 60 candlepower, and 175 of 80 candlepower) supported on gooseneck brackets attached to wooden poles and equipped with radially fluted reflectors in the residential section. This system, which has been extended so as to illuminate the streets of Warren to the city limits, went into operation on June 7, 1911, and has already attracted a great deal of favorable comment, not only locally, but nationally through the electrical press.[1] Salem still has arcs.

Hearing that the street-lighting franchise of the Salem Electric Light & Power Company was about to expire, a committee of public-spirited Warren citizens extended to their neighbor an invitation to "come over and see how we do it." The invitation was accepted, and resulted in what might appropriately be called a "street-lighting excursion."

1 See ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, July 1, 1911, page 25.

On Friday, July 21, a delegation of more than fifty prominent residents of Salem, headed by the mayor and including members of the City Council and leaders in the city's business activities, all of them personally and vitally interested in municipal improvement, took a trolley trip to Warren for the purpose of inspecting its new lighting system and to consider informally the advisability of installing a similar one in their home town.

The party arrived in Warren early in the evening and was met by the mayor, the president of the Board of Trade and other citizens. After supper automobiles were pressed into service and the whole delegation was conveyed east past the City Hospital, around the Public Square, via Main Street to the Erie Depot, via West Market Street to the city limits, and return. This ride gave them an ample opportunity to judge of the efficiency of the lighting system, demonstrating not only its ornamental value, as shown in the center of the city, but also its practical value in illuminating even the most remote residence streets.

To some of the visitors, who had vivid memories of fearsome drives along inky-dark suburban roads, the experience of spinning through the outlying districts of Warren over a well illuminated roadway that could be traced by the lighting units far into the distance, was both a pleasure and a revelation. Although there was no moon on the night of the excursion, the automobile headlights were used more out of deference to the guardians of the peace than as a necessity in driving. Many questions regarding the general features and technical details of the street lighting were asked by the visitors, and the desired information was furnished by members of the inviting committee, who mingled freely with the party, explaining and describing such points as might otherwise have been overlooked.

Under the expiring contract of the Salem Electric Light & Power Company with the city of Salem, the company maintained about 150 direct-current carbon arcs, on a moonlight schedule at $70 each per annum. The arc lamps have a rated consumption of 325 watts. Although it is perhaps too early to make definite predictions, yet as a result of the street-lighting excursion of July 21, there is little doubt that when the contract is renewed it will be on quite a different basis, for the central station is taking a co-operative attitude with respect to the progressive movement that has been started. It is strongly intimated, by those who should know, that Salem will ultimately have a street-lighting system very similar to that of Warren.

Civic pride is emulative; and in nothing is that fact more clearly evident than in street lighting. Minneapolis, for instance, which was one of the first cities to install ornamental poles with incandescent lamps for street lighting on a large scale—before the days of the metal filament—has become the nucleus of a steadily increasing group of important cities that can trace the reason for their adoption of essentially similar systems back to her example. There are still opportunities in hundreds of regions throughout the country, for enterprising cities to become patterns unto their neighbors in the matter of street lighting, and to secure for themselves those benefits in trade, adornment, protection and prestige which can in no other way be obtained at such reasonable cost or with such satisfactory results.

Photometry of Rectilinear Light Sources.

As stated in a recent number of *Elektrotechnische Zeitschrift*, mercury lamps and Moore tubes necessitate certain changes in our present theories of photometry of rectilinear sources of light.

M. Pole, the author of the article, has established certain formulas relative to illumination from such sources; he criticises the regular methods of calculation of light flux in that which concerns their application to rectilinear sources, and shows that figures obtained by these methods are not exactly correct. Research in this line has led the author to propose a new definition of total luminous flux from a rectilinear source, with a new formula for its calculation.

By the aid of a somewhat long and involved calculation he arrives at this formula:

$$\Phi = \pi^2 IL$$

in which Φ is the total flux from the rectilinear source; I, the luminous intensity per centimeter of the source measured perpendicular to the axis, and L its length.

M. Pole proposes, consequently, to define the expression $\pi^2 IL$ as the total flux, and to take this unit as the basis of comparison for the photometry of rectilinear light sources.

ILLUMINATION OF THE WORLD'S LARGEST TRANSMISSION-GEAR FACTORY.

BY ROSCOE SCOTT.

When the first practical chainless safety bicycle was placed upon the market, the event was proclaimed as denoting a distinct advance in the design and manufacture of accurate, durable gears for power transmission on vehicles. Vastly more numerous, varied and exacting uses for gears have come into existence with the development of the motor vehicle and the growth of the automobile industry, so that today the making of transmission gears gives employment to an army of skilled workmen. The artificial illumination of the largest factory devoted to this business may be of some interest to illuminating engineers.

The so-called "selective type transmission," using gears that are slid in and out of mesh is in much more extensive use for automobiles than is the "planetary type transmission," and accordingly the output of gears for the former type is very much greater. While there are large gear works in Marseilles, France, and in various other cities both here and abroad, the world's largest manufactory of sliding transmission gears is said to be the new plant of the Brown-Lipe-Chapin Company at Syracuse, N. Y. Bevel gears for the transmission of power to rear axles are also made in this establishment.

As shown in Fig. 1, the factory is of fireproof, reinforced-concrete construction, and contains nearly two acres of floor space. The main thought carried out in the design of the structure was to secure efficiency—space-efficiency, material-efficiency, time-efficiency, man-efficiency. The large heating ducts, for instance, were run up outside of the building, so as not to waste manufacturing space, and it needs but a glance at the exterior view to prove that the industrial value of daylight was realized in the laying out of the windows.

FIG. 1.—EXTERIOR VIEW OF FACTORY.

It is with the artificial lighting, however, that we are primarily concerned here.

Advantage was taken of the opportunity afforded by new construction to install at minimum cost a sufficient number of wiring outlets for all probable future needs. A difficulty frequently met with in old factories in remodelling lighting installations that were originally designed for arc lamps, is that the outlets are spaced many times too far apart to permit of a satisfactory distribution of light with the commercial units now available, and radical changes must be made in the spacing, if units of moderate intensity are to be used. Too often the owners will not consent to such changes, and single lamps or clusters of extremely high candlepower are hung up at the existing outlets where they never were intended to be seen. Even where open-mill wiring is installed, as in this gear factory, the addition of outlets after the construction is completed would ordinarily involve considerable more expense than is required to provide a sufficient number in the beginning. Throughout the Brown-Lipe-Chapin building the outlets are spaced in squares, 11 feet 6 inches apart. As a matter of fact, experiments were tried with flaming-arc lamps and with high-candlepower incandescent shop clusters before it was finally decided, on recommendation of the Engineering Department of the National Electric Lamp Association (which was called into consultation by the Sterling Electrical Manufacturing Company), to adopt as the lighting unit the single 100-watt metal-filament lamp with radially-fluted reflector.

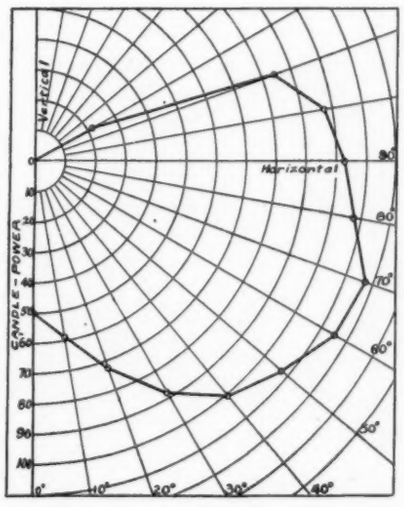


FIG. 2.—DISTRIBUTION CURVE OF LIGHTING UNIT.

The lamps are operated in multiple on 110 volts alternating-current and are controlled by group switches. Energy for lighting and group-drive motors is purchased from the Syracuse Lighting Company, which receives it at high tension from Niagara Falls. On account of the low price paid for energy, the saving in electricity bills was only a minor reason for the use of metal-filament lamps in this installation, the chief reason being their adaptability to the illumination requirements.

The lighting equipment is installed according to a uniform scheme throughout the building, the 100-watt clear Mazda lamps being suspended at a height of about 8 feet 6 inches above the floor and spaced 11 feet 6 inches apart. Each lamp is provided with a

radially-fluted reflector sixteen inches in diameter, of the type known as FEC-100. The characteristic distribution curve of such a unit, as determined by a photometric test where readings were taken every ten degrees from nadir to zenith in a mean vertical plane, is shown in Fig. 2. The curve, as will be noted, is widely extensive. Enough light is emitted in directions above the horizontal to facilitate the repairing, adjustment and oiling of shafting, belts and pulleys placed near the ceiling. Most of the machinery is entirely automatic in operation, so that a fairly high general illumination answers every purpose save in certain places where a strongly localized light is required at intervals for the setting of internal parts of the machines. In such cases, portable lamps are used for the setting, which in many cases need not be altered for days at a time.

The accompanying series of pictures, which were taken by no other light than that of the lamps, will give some idea of the effect of the illumination in the various rooms as regards the quality of revealing detail and the lack of sharp, objectionable shadows. It is impossible in a reduced half-tone engraving to do full justice to the photographs, and the experienced eye will make allowances for this fact.

The photograph of the lathe room on the first floor, reproduced in Fig. 3, was taken at about 7:45 p. m., according to the witness of the time-clock in the original picture. Piles of uncut bevel gears are seen at the right, and piles of gear-housings at the left. In the original print the metal chips on the floor, under the lathes as well as in the aisle, can be seen with great distinctness.

A section of the largest installation of Jones & Lampson automatic turret lathes existent in a single building in the world is shown in Fig. 4. It is on the second floor. In this room no extension cords or portable lamps are used, the general illumination being sufficient for every detail of the work, and giving a daylight effect which no possible amount of concentrated lighting could produce. The lamp bulb in the foreground was unscrewed before the picture was taken, in order to prevent excessive halation on the photographic plate.

Fig. 5, taken on the third floor, represents the largest installation in the world of Gleason "generators" or gear-cutting machines, but from an illuminating standpoint the most noteworthy fact about the machines is that their gauges are graduated in divisions corresponding to one ten-thousandth of an inch movement of the tool. One portable lamp on an extension cord is provided for every four machines and is used by the operators in the close work of setting these gauges.

The drill-press room, on the fourth floor, shown in Fig. 6, calls for but lit-

FIG. 3.—LATHE ROOM.

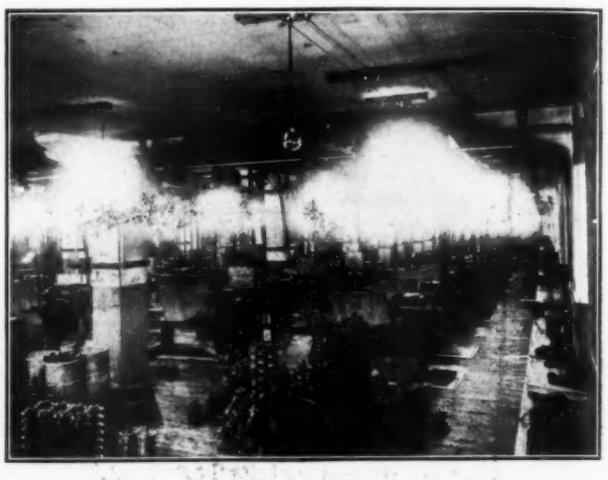


FIG. 4.—AUTOMATIC-TURRET-LATHE ROOM.

FIG. 5.—GEAR-CUTTING ROOM.

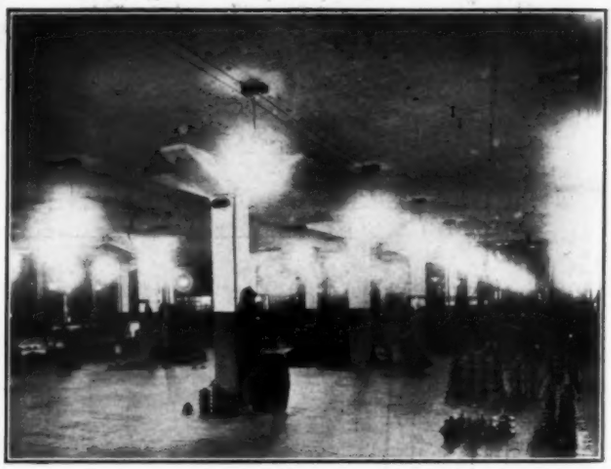


FIG. 6.—DRILL-PRESS ROOM.

tle comment. The general lighting suffices for all requirements, the presses being so located with respect to the lamps that it is impossible for an operator to be handicapped by his shadow falling across the work. In the grinding room, also on the fourth floor, a number of lamps on drop cords have been provided in order to give the localized lateral distribution of light wanted for internal grinding.

A casual inspection of the pictures might lead one to criticise this installation on the score of glare, but as a matter of fact the lamps are placed at such a height that no trouble of such a nature is experienced; moreover, the operators' eyes are much more likely to be upon the work on hand than to be roaming about the ceiling. Glare becomes a real source of inconvenience and discomfort in some factories of this kind, where the machinery is lighted—or to put it more accurately, the gloom is speckled—by sparsely distributed lamps of low candlepower, hung at about the level of the mechanics' eyes. The Brown-Lipe-Chapin Company is to be congratulated on having no "horrible example" of this sort throughout its modern plant.

The illumination of the world's largest transmission-gear factory is a fair indication of the increasing use of metal-filament lamps for exacting conditions in industrial lighting; it is further an indication of the co-operative attitude taken with regard to illuminating engineering problems by one of the prominent incandescent-lamp companies of this country; and finally, it indicates the increasing stress that is being laid on scientific illumination by wide-awake manufacturing concerns. It has been stated by officials of the factory in question that the efficiency of the night force is more than ninety per cent of that of the day force, and this unusually high percentage is attributed, in part at least, to the excellent lighting conditions.

CHICAGO PARK FRONTAGE.
Arc Lamps 96 Feet Apart on Low Posts.

STREET IN WARSAW, RUSSIA.
Flaming Arc Lamps on Tall Trolley Poles.

Park-Front Lighting: A Contrast.

Among the vexatious problems in any system of lighting which covers a variety of conditions, is that of lighting the parts that are "betwixt and between," for whenever there is a difference either in the lighting units adopted for adjoining sections or in their arrangement, there must be an overlap between the two. Thus in the case of park frontages there usually is a broad walk with no buildings to reflect the light of the street lamps or possibly to aid in lighting the walks by the rays from window and sign lamps. In that case, should the street lights be depended upon for lighting these park-front walks also, or should the walk be treated as if it were a separate street, requiring additional lighting units?

Both plans are depicted by the illustrations herewith, which show a striking contrast between the lighting methods in vogue in prominent American and European cities. At Chicago the walks have been treated to a separate system of arc lamps, those used for the street lighting being placed along the opposite curb where they would not effectively distribute their light across the park walks.

The result is that the two lighting systems resolve themselves practically into means for lighting both walks, leaving the roadway as well as the park proper (excepting a narrow strip alongside the park walk) rather poorly illuminated.

On the other hand, the Russian practice of placing flaming arc lamps at the center of the roadway on much higher posts offers good lighting for both the street and the sidewalks. It also makes the adjoining portions of the park bright enough to be safe and attractive. Very likely the fact that the parks and the streets at Warsaw are under common control may account for the difference, as the two sets of lamps shown in the Chicago picture are supplied by two bodies supported by separate taxes. If so, the need of a more unified scheme of lighting ought at least to warrant a revision of the methods so as to make the results compare more favorably with this example of European practice.

The Production of Aluminum.

The development of the aluminum industry has been unusually rapid, the world's production having risen from 11,500 metric tons in 1905 to 34,000 metric tons in 1910. The distinctive feature about the aluminum trade is that it is in the hands of only ten companies.

Pennsylvania Electric Association.

Fourth Annual Convention at Exposition Park, Conneaut Lake, Pa., September 5, 6, 7 and 8, 1911.

Unquestionably the most successful meeting in the history of the Pennsylvania Electric Association was the fourth annual convention held at Exposition Park, Conneaut Lake, Pa., September 5, 6, 7 and 8. The registration on the first day was somewhat over 245, which considerably exceeds that of the last meeting. Exposition Park is a summer resort noted throughout the state of Pennsylvania, and every facility for providing enjoyable entertainment features was at hand. The final registration was 305.

The convention was opened on Tuesday evening at 8.30 p. m. by a reception tendered to President Granger and the other officers, this being followed by a dance. The formal opening took place Wednesday morning shortly after 9 a. m., when the President called the meeting to order, and started the routine business. After calling for a vote on a motion to dispense with the roll call and the reading of the minutes, President Granger delivered the annual address.

He briefly reviewed the work that has been accomplished by the Association during the past year, emphasizing particularly the remarkable increase in membership. In 1910 there were 492 members, while at the beginning of the 1911 convention there are a total of 954 members, showing a gain of over 100 per cent. He referred to the report of the Committee on By-Laws, subsequently presented before the convention, which radically changes the requirements for membership and is in accordance with the membership requirements of the National Electric Light Association. Mr. Granger also referred to the action of the Executive Committee of the National Electric Light Association in discontinuing the practice of making chairmen and presidents of the Geographic Sections ex-officio members of the Executive Committee of the parent body. He spoke briefly of the bills that had been introduced in the legislature affecting public-utility operation, and urged that all member companies take an active interest in and co-operate with the officers in this respect.

In conclusion, President Granger commended the work of the various committees, referring particularly to the work of the Program Committee, commending it for having printed and distributed, ten days in advance, all papers and reports of Committees, presented at the convention. This action, he stated, was without precedent in state electric-light associations.

W. C. Anderson as a member of the Program Committee, presented a brief report; this being followed by the report of the Executive Committee by R. S. Orr, vice-president of the Association. Mr. Orr reported that six meetings of the Committee were held during the year at which the routine business was taken up. Action on two matters of importance was reported in detail. The first was the acceptance of an invitation extended by the Electrical Exhibition Company of Philadelphia to the Pennsylvania Association to attend the Philadelphia electric show and on a day set aside for this purpose, called Pennsylvania Electric Association Day. The second, was the filing of the protest regarding the action of the National Electric Light Association referred to in President Granger's address.

The report of the secretary-treasurer, which was then presented, showed the Association to be in a sound financial condition. The President appointed an Auditing Committee, consisting of W. C. Anderson, H. S. Orth, and W. R. Ottey, to certify this report.

In the report of the Membership Committee, which was then presented by Chairman R. S. Orr, the methods of securing new members, which, during the year just ended, have met with such marked success, were outlined. The state was first divided into geographical sections, and a member of the Committee appointed a supervisor of each section. A form letter was sent to each company in the state not already a member, and this was followed up by a personal letter and calls, when practicable, by the various supervisors.

At this point President Granger appointed a Nominating Committee, consisting of Thomas Sproule, W. A. Donkin, and H. N. Spencer. Chairman George B. Muth, of the Entertainment Committee, then called attention to the various entertainment features scheduled.

The report of the Committee on By-Laws was then read by L. H. Conklin, chairman. The only change of any note is that affecting the requirements for membership, as previously mentioned, in connection with the President's address. The new law provides for Class A, B, D and E members, and is similar to the By-Laws of the National body with the exception of that no Class C members are provided for.

The report of the Lamp Committee was then, in the absence of the Chairman, read by H. M. Simkins, of Philadelphia. An abstract of this report is given herewith.

REPORT OF LAMP COMMITTEE.

This report presents in a concise manner a general resumé of the lamp situation, together with the compilation of the answers received from a number of companies to a set of questions sent out by the committee, in an effort to obtain some information which might be of value to the members. The tendency of lighting companies during the past year has been to replace carbon lamps with Gem lamps, as a free renewal lamp, and supplement Gem lamps with Mazda, a charge being made for the latter depending upon the policy of the different companies. The Gem lamp seems to be the logical lamp to replace carbon lamps. Its nominal efficiency is 2.5-watts per candle with the same life as a carbon lamp at 2.97-watts per candle. This means twenty per cent increased candlepower for the same wattage consumption. The Gem lamp is available in sizes 50, 60, 80 and 100 watts, and it may, therefore, readily replace carbon lamps of equivalent wattage, thereby maintaining the present revenue, or may replace carbon lamps of equivalent candlepower where it is desired to effect a saving to the customer. A very flexible manner of substituting is therefore possible by which central stations may bring about any desired result. Experience has shown that where lighting companies have encouraged and at the same time controlled the general use of the Mazda lamp a marked improvement in new business, old business and relations with the customer has been the result. Within the past year the construction of the Mazda lamp has changed considerably; the filament is of drawn-wire tungsten, and instead of being composed of a number of hairpin loops, joined together in series, it is continuous, and therefore not subject to the variations in size which were apt to occur with the pressed filament. The loop ends of the draw-wire filaments are not narrow and pointed, but are wide and well rounded, overcoming the tendency to interlock or short circuit. The drawn-wire filament appears to be stiffer at operating temperatures, and does not sag as does a pressed filament, and there is, at time of installation, less liability of the lamp being broken by rough handling. Mechanical tests have demonstrated that at any period during its life the drawn-wire filament is several times stronger under similar conditions than the old pressed-filament lamp, and the commercial scope and value of the Mazda lamp has been vastly increased by

the use of drawn-wire filament. It has now become the practice to rate all carbon, Gem, Mazda and tantalum lamps for commercial circuits on a wattage basis. The term "candlepower," originally used in the carbon lamp, was a much abused term in that different light sources gave different candlepowers in different directions, and it was always necessary to state in what manner this candlepower was measured. Also, considering an incandescent lamp as an energy-consuming device on which the cost of operation was usually based on the wattage consumed, the "wattage" method of rating seems to be the most desirable. To obtain the candlepower it was then simply necessary to divide the wattage of the lamp by its efficiency in watts per candle. The standard line of lamps in all classes for the 110-volt range has been labeled with a "three voltage label." With the advent of the high-efficiency lamps commercial practice has been profoundly modified, and with the possibility of these lamps being made more efficient in the future it is necessary for the central station to adopt policies, programs and methods which will not only take care of the lamp situation at present, but which will provide for any increase in efficiencies in the months and years to come.

R. S. Orr, of Pittsburgh, opened the discussion, calling attention to the great volume of business that has been obtained since the advent of the high-efficiency units, that could not have been obtained with the carbon lamp. He said that, in view of the progress that has already been made, he looked forward to the time when electric lighting will be used exclusively.

H. Harris asked if tests, carried on by the Lamp Committee, had determined the recommendation of the drawn-wire filament to the exclusion of the pressed filament. H. M. Simkins said that the Committee only meant to convey the idea, the drawn-wire filament of continuous type had greater strength than the hairpin type of filaments.

W. L. Mason also spoke on this question, pointing out that the mechanical strength of the drawn-wire filament is about five times greater than that of the pressed filament. He said, however, that after a period of 100 hours burning both types show a crystallization, which is even more marked in the pressed filament.

E. F. McCabe said that his experience has been disappointing, so far as the drawn-wire-filament lamps are concerned. In practically all of the installations he has made, they show a greater tensile strength when used, but blacken and break just as quickly as the older types.

H. N. Müller said that, in the perfection of the drawn-wire and pressed-filament lamps, the manufacturers have undoubtedly obtained greater mechanical strength, but the chemical defects are responsible for the blackening in just as great a degree as heretofore.

Secretary Rickert called attention to an installation of tungsten sign lamps in which the breakage was excessive. He found that by reducing the period of outage, and slightly reducing the voltage, this trouble was practically eliminated.

H. N. Müller, in connection with Secretary Rickert's discussion, called attention to the practice of railway companies, using low-voltage lamps in maintaining some current in all lamps and not allowing the filament to cool and thus become brittle.

E. F. McCabe asked if the cost of installations of low-voltage lamps in connection with step-down transformers was justified. In replying to this Mr. Müller said that the operating efficiency and the general satisfaction given by such an installation certainly justified the cost.

In concluding the discussion on this report, E. B. Greene described an installation of excess indicators in connection with twenty-five-watt tungsten lamps, which was very unsatisfactory. To overcome the excessive breakage due to this installation lamps rated at eight volts over the voltage of the line were used with gratifying results.

The report of the Steam Heating Committee was then presented by M. J. Fogarty, who also read the paper entitled "Central Station Heating" by E. J. Kiefer.

STEAM HEATING.

The report of the Committee on Steam Heating is very brief but is supplemented with a paper on the same subject by E. J. Kiefer. The report states that it is a very difficult matter to procure data from heating companies, as there seems to be a great unwillingness to divulge information. Regarding the question of rates, it is felt that it would be impracticable to advocate a uniform rate, but the Committee has obtained the prevailing rate charged by at least one hundred companies in this and other states, and find that the average is about forty-five cents per one thousand pounds of condensation. If it is desired to keep thorough and accurate records, member companies might be benefited to a considerable extent by obtaining the blanks furnished by the American District Steam Company, who have made a very thorough study and analysis of this subject.

The paper by Mr. Kiefer presents five factors to be considered when establishing a heating system. These are (1.) the relative quantities of steam required for power and for heating; (2.) the length of the heating season; (3.) the type of the engine used; (4.) the steam pressure at the boilers; and (5.) whether the plant under consideration is entirely new, or whether the adoption of an old heating system to a new plant is involved. The first use to be made of exhaust steam is the heating of the feed water, thus effecting a constant saving both summer and winter. This is done without materially increasing the back pressure on the engine. Under ordinary conditions about one sixth of the steam supplied, or more nearly one fifth of the exhaust discharge from the engine, can be used in this way. It can be assumed in average practice that about eighty per cent of the steam supplied to an engine is discharged in the form of exhaust steam at a lower pressure, the remaining twenty per cent being partly converted into work and partly lost through cylinder condensation. Therefore the actual steam available for steam heating is 64 per cent of the steam delivered to the engine. As all central stations, in order to be successful, must be operated on a dividend-paying basis, it is most necessary to keep operating expenses at a minimum, at the same time maintaining rates that are commercially fair. Assuming that the operating expenses are at a minimum, and that the company is not on a dividend-paying basis, the rates must be raised. However, in the majority of cases it is possible to very materially decrease operating expenses by carefully analyzing the efficiency of the boiler plant, the efficiency of the engines and the condition of the steam or hot-water pipes installed in the station. If it is a combination plant, the advisability of making a change in the plant should be carefully considered. The flat-rate system is inherently wrong, since it does not encourage economy or efficiency of operation by the consumer. It will obviously be of advantage to a central-station company to advocate a system of charges which will encourage economy and efficiency of operation on the part of the consumer by giving to the consumer a goodly portion of the pecuniary benefits arising from the use of such economical methods. The consumer may not realize the possibility of making these economies, and, due to his ignorance may be in a state of chronic discontent. Advice as to the proper method of economizing, and a rate system which will make it worth his while, will in time convert him from a position of indifference to one of enthusiasm. Heating companies at present favor the use of a meter which measures the condensation from the various radiators and pipes throughout the building. For this condensation a price usually about one-tenth the cost per ton of anthracite is made for each 1,000 pounds of condensation measured. On this basis it is assumed that the maximum efficiency of the ordinary isolated private plant would be an evaporation of five pounds of water per pound of fuel, in which case a ton of fuel would produce 10,000 pounds of steam.

L. H. Conklin opened the discussion on this report by asking for experiences of members in using meters on the vacuum return system. E. F. McCabe, in reply, said that he had collected data on this subject about six years ago. He wrote to over 200 central-station heating companies and all replies indicated that none were returning the water of condensation to the plant.

J. E. Pyle spoke of the trouble that he has encountered in connection with the use of meters. They have to be cleaned, inspected, and adjusted annually, and, in atmospheric systems of heating, the meters frequently have to be adjusted for each particular installation.

W. J. Kline, referring to Mr. Conk-

lin's question, said that most meters in use are on gravity systems. The older types of condensation meters gave a great deal of trouble, as outlined by Mr. Pyle; the newer types as now being brought out by the manufacturers are giving very little if any trouble, with the exception of the periodic cleaning, which Mr. Kline said was a necessary evil. Regarding the use of meters in general, he said that the failures in steam-heating plants could invariably be attributed to the flat-rate system of charges.

E. H. Davis asked if heating plants are considered a financial success. Mr. Pyle replied to this question in the affirmative, stating that the Company with which he was connected, earned $18,000.00 last year, which amount covered the coal bill, water bill, boiler-house labor, and all repairs on the entire steam equipment. He said that this compares very favorably with a gas-producer electric plant, which is recognized to be the most economical under certain conditions. Other advantages of central-station heating, enumerated by Mr. Pyle, were that real-estate values along the lines of the heating mains increased fully twenty per cent during the nine years this system has been in operation, and also that the central-station company has a stronger foothold in its locality, due to the combined commodities furnished.

In reply to a query D. T. Campbell said that his company has taken over three live-steam plants and changed them over to exhaust steam, this in addition to the three plants previously maintained by the company. He said that, while no figures can be given at present, encouraging results were looked for in the near future.

R. S. Orr inquired if any tests were available as to losses in distributing mains. He asked whether losses were constant for the various sizes of pipe, and for various conditions of soil. W. J. Kline stated that he knew of no company in Pennsylvania which had made such tests, but that accurate data on this subject was available from several western companies operating steam heating plants. He added that there is no definite rule for accounting for loss in mains, but stated that stations should be able to account for seventy per cent of the steam passing through the station meter.

THURSDAY SESSION.

The session on Thursday morning was called to order by President Granger at 9:00 a. m., and the paper by A. M. Dudley, entitled "Motors" was taken up. An abstract is given herewith.

MOTORS.

This paper is an elementary treatise of the fundamental principles of alternating and direct-current motors, together with a brief theoretical discussion on motor-starting and controlling devices. The paper is divided into three general parts, the first treating of constant-speed motors, the second of adjustable-speed motors and the third of varying-speed motors. Wiring diagrams of the various types of machines coming under these heads are presented and discussed, together with characteristic curves of these motors showing the condition under which each type operates. The paper concludes with a brief summary of the most suitable applications for each type of motor. One important point emphasized in the paper is that the best motor for general service is one in which all the conditions are nicely compromised and the motor starts well and runs well. This condition should be demanded instead of excellence in any one or two features with a sacrifice of the others.

W. L. Robertson asked what the advantage or disadvantage was of using high-speed motors with great speed reduction or low-speed motors with lower speed reduction. Mr. Dudley expressed the opinion that it was better practice to adhere to motors of moderate speed, with a conservative ratio of reduction

E. F. McCabe, referring to Mr. Dudley's statement that the no-voltage-release feature was not essential in motor control, asked if he did not advise using a no-voltage release on motors used on 2,200-volt circuits. In reply, Mr. Dudley said that as far as injury to the motor itself is concerned, there would be no danger.

At this point John F. Gilchrist, president of the National Electric Light Association, arrived, and delivered a very excellent extemporaneous address on the functions of the National Electric Light Association. Mr. Gilchrist first congratulated the Pennsylvania Electric Light Association on its large membership, and on the excellent attendence at the Convention.

Likening the relation between the National body and the geographical sections to the United States government with the individual states, Mr. Gilchrist said that the primary function of the N. E. L. A. is the protection of the central-station industry by a closer union of the companies engaged in the business. The next important function is the development of the business itself as exemplified by the various conventions and meetings that are held. He said that owing to the rapidly changing conditions in the electrical industry, and also to lack of time on the part of the leaders in the industry, the majority of text books on electrical subjects cannot be applied to central-station conditions as they exist today. The information that the members obtain from attending conventions is of the greatest value and the printed transactions of meetings form the highest character of electrical literature. The third function mentioned by Mr. Gilchrist is the serving of the company membership by acting as a clearing house for all information that the members desire. The fourth function is that of preserving the records and literature of the industry. Mr. Gilchrist explained that this feature would be appreciated more fully in later years. He said that the tendency of companies starting in business is to fail to keep records which later might have proved very valuable. This situation was found to be the case in the Commonwealth Edison Company of Chicago, who at the present time is preparing a history of its business, and finds data on its early business very meager. Speaking in general terms of the relation between the National association and the state associations Mr. Gilchrist said that the latter should be supreme in all local matters. He said that in the future undoubtedly the best work will be done by the various state associations. He looks forward to the time when the membership of the organization will be double or triple that at present, when it will be impossible to hold conventions as at present. One of the greatest functions in the state associations will be the bringing out of the able men in the industry, also company sections, the establishment of which Mr. Gilchrist strongly urged, will bring out the able men in the various companies. Speaking of the size and influence of the National Electric Light Association, Mr. Gilchrist said that practically five per cent of the total population of the United States depended for their livelihood upon the electrical industry. A large proportion of these people are represented in the N. E. L. A., so that an idea may be gained of its influence. This influence is held ready to protect the central-station company together with the enormous financial backing that it represents. In conclusion Mr. Gilchrist referred to the coming convention in Seattle that is to be held in May of 1912, and urged that the Pennsylvania Electric Association send a large representation to the meeting.

A rising vote of thanks was tendered Mr. Gilchrist for his presence at the convention, and his interesting address, following which the paper by P. H. Bartlett, entitled "Service Connections," was presented.

SERVICE CONNECTIONS.

This paper treats at some length the practice of the Philadelphia Electric Company in the matter of service connections, presenting throughout the text extracts of rules and requirements of a company operating in Pennsylvania. Underground service is first discussed.

The question of terminating underground service in vaults or extending them through the vault and terminating them just inside the building line, should be given some consideration. If no vault existed, the company would naturally carry the service through the main foundation wall and is, therefore, in a sense, not put to any additional expense. Vaults are usually an undesirable location for meters on account of dampness, lack of ventilation, and also because of the fact that they are frequently used for coal, ashes or rubbish. It is, therefore, advisable to carry the service cable directly through the vault and install the service switch inside the building, and this practice will, no doubt, be endorsed by any underwriters or other inspection boards, providing that the service cable is protected by duct where this is deemed necessary.

Complete specifications are given for underground service and for general systems

of distribution. Regarding location of meters, the author states that the meter location is a question which has excited considerable discussion in the past, and regarding which there still exists some rather widely divergent views. Some meter engineers contend that the attic or upper floor is the most desirable location that could be obtained, and that the cellar or basement is the most undesirable location, due to the fact that any dampness, if it exists, will be found there. This view of the matter is probably true, if we consider the meter only, although experience with some 20,000 meters located in cellars and a like number located on the upper floors would indicate that there is no appreciable difference in the cost of maintenance. There are many points other than the meter as a meter, however, which must be considered, some of which have already been reviewed, and there is one very important point namely that the meters should, under no circumstances, be installed in any location where the visits of the meter readers or testers will be apt to cause the least annoyance to the consumer.

There being no discussion, the paper by Professor J. P. Jackson, of the Pennsylvania State College, on "The Preservative Treatment of Poles and Crossarms," was read. This paper is a criticism of the report of the National Electric Light Association committee on this subject, and is embodied in the report of the Pennsylvania Association Committee on Overhead Line Construction.

PRESERVATIVE TREATMENT OF POLES AND CROSSARMS.

This paper gives a brief summary of what represents the most useful knowledge concerning the preservation treatment of poles and cross arms, much of the data being abstracted from the pamphlet of the National Electric Light Association on this subject. The subject of seasoning is considered first, the author giving the directions for the most approved methods. Insects and causes of decay in timber are explained and methods of overcoming the difficulties in this connection pointed out. Under classes of preservatives, all methods known for preserving timber are enumerated. The primary objects to be obtained are: (1) The choice of the best preservative for the protection of poles and cross arms obtainable at a cost commensurate with its service. (2) Specifications which, while fully covering the requirements of a high-grade preservative, would at the same time be fair to the manufacturer and provide material no more expensive than the best grades now on the market. (3) A method of analysis which would insure compliance with the specifications. Specifications are then given for coal-tar creosote oil and method of analysis; specifications covering mixed oils and methods of analysis; and specifications covering water-gas tar creosote oil. Under methods of treatment the high-pressure treatment, two open-tank treatments and the brush treatment are described, also the appliances. Regarding cost the following deductions are drawn from the body of this discussion: (1) Proper cutting and seasoning of poles prepares them for preservative treatments and reduces their weight in transportation; (2) Preservative treatment is profitable financially, particularly so for the softer woods; (3) Preservatives enable the use of the less expensive timbers; (4) The size of treated poles may be determined upon strength with less reference to the question of decay; (5) The best preservative material is apparently coal-tar creosote, and is probably the most economical in the end. This is not intended to exclude the use of other preservatives under special conditions or where creosote oils are unavailable; (6) The high-pressure process is the most thorough. It, however, requires treatment of the whole pole and is therefore more expensive. It is also frequently unavailable; (7) The open-tank process is quite efficient and small plants can be erected at comparatively little expense; and (8) The brush process, where the more efficient methods are unavailable, is advisable. Gains, roofs and other cross cuts, where not otherwise treated, should have applications of the hot creosote oil by the brush process.

Thomas Sproule opened the discussion, calling attention to the high cost entailed in installing and maintaining preservative plants. In Philadelphia all poles have been given the brush treatment, but as this was only started three years ago no results are as yet available.

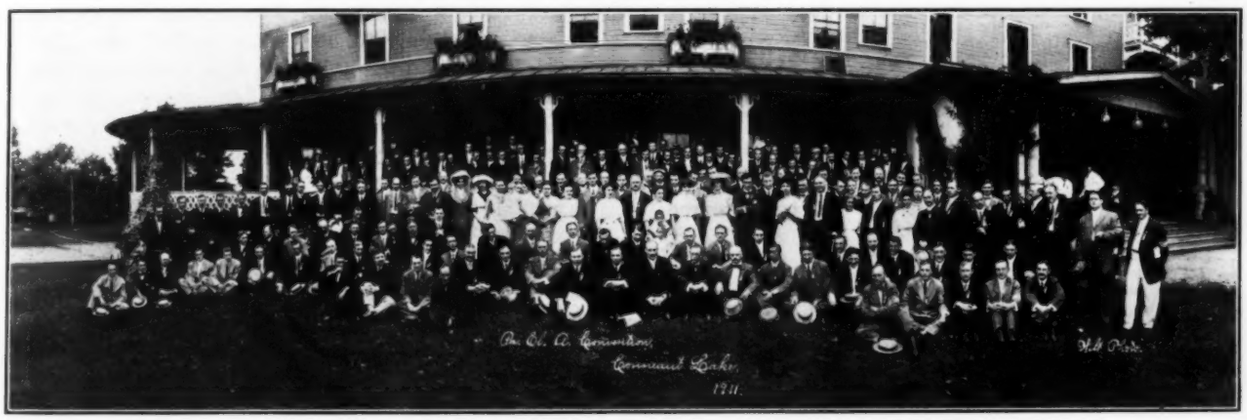
W. C. Sharp said that poles are treated in Pottsville to a distance of eight feet from the butt. Here also no results are available. H. N. Müller called attention to the cost of maintaining open-tank plants where two or more pole yards are used by a company. He added that unless poles are seasoned the brush treatment is not of much value.

E. F. McCabe suggested that it would be more feasible for the pole dealers themselves to erect and maintain large treating plants so that the central-station companies could buy the treated poles. The first cost of open-tank plants is too high for the average electric company.

E. B. Greene referred to an installation of poles that had been made in Bellefonte some twenty-six years ago, the poles still in good condition. He said that some were treated with boiled linseed oil and charcoal made from willow, while others were treated with gas tar. At present all poles are treated with dead oil applied by the brush method.

J. H. MacDonald, of the Pennsylvania Railroad, said that this company has, in recognition of the importance of treating ties and poles, erected a large creosoting plant where all of this work is carried on. R. D. Coombs stated that he has had experience with creosoting ties and poles for periods long enough to indicate that this method is very satisfactory.

Professor Jackson closed the discussion, by urging that central-station companies give more consideration to the subject of preservative treatment of poles and crossarms, as it will be the means of saving considerable money in the future. He called attention to the inherent advantages of the open-tank method and said that this will eventually replace the brush treatment.



GROUP AT CONVENTION OF PENNSYLVANIA ELECTRIC ASSOCIATION.

AFTERNOON SESSION.

The afternoon session was opened with the paper by William LeRoy Robertson, entitled: "Data on Sag and Span Calculations," which was also em-

bodied in the report of the Committee on Overhead Line Construction.

DATA ON SAG AND SPAN CALCULATIONS.

This paper presents brief supplementary data to the paper on this subject presented before the recent convention of the American Institute of Electrical Engineers, at Chicago. The paper consists of a series of additional tables to be used in calculating the proper sag and stress values to be used in the erection of overhead lines.

There being no discussion, the report of the Committee on Overhead Line Construction was then presented. This report is divided into five sections, these being assigned to the various members of this committee, who presented them.

OVERHEAD LINE CONSTRUCTION.

This report was compiled by a committee consisting of F. M. Noecker, chairman, H. N. Muller, George E. Wendle, W. C. Sharp and J. S. Jenks and is really a criticism of the report of the National Electric Light Association's committee on this subject. Those points of the National committee's reports are selected which were believed to be fundamentally wrong, or which are prejudicial to the best interest of Pennsylvania companies. The report is divided into five sections, corresponding to the similarly numbered sections of the national report, covering the following subjects: I. Specifications for overhead line construction for 2,300-volts distribution, and for street lighting, and specifications for materials covering secondary distributing systems; II. Specifications covering methods of overhead line construction for secondary voltages, including pole wiring for street-lighting work; III. Covering joint use of poles by lighting and telephone companies; IV. Specifications for overhead crossings of electric light and power lines; and V. Maintenance and inspection. Under Section I the report states that certain specified test must be carried on with untreated cross arms before any standards for them can be required of the manufacturers. The section dealing with locust pins was criticised, the report holding that extension test must be made before standard specifications can be made. The report recommends that Section II of the National report be entirely eliminated. Regarding Section III the committee suggests that where a company desires to use a pole jointly with another company, the former should at once pay half the expense of yearly maintenance and cost, thus simplifying the present record-keeping that is necessary. Section IV was severely criticised, nine reasons for the criticisms being given as follows: (1) Require special construction of all electric light and power wires (except trolley contact wires) crossing over railroad right-of-way, tracks, or lines of wire, regardless of the voltage carried by the crossing wires; and crossings constructed over telephone, telegraph or other similar lines when the electric light and power wires carry over five thousand volts constant potential. (2) Are not definite in one important particular. (3) Require relinquishment of the legal rights of electric light and power companies. (4) Require unnecessary clearances. (5) Require unnecessary and unduly expensive construction at wire crossings. (6) Require construction which is insufficiently tried and experimental. (7) Require sags which do not agree with the experience of operating light and power companies. (8) Do not cover the cases when electric light and power wires are crossed over by railroad lines of wires, telephone, telegraph, or other similar lines. (9) If adopted, will injuriously affect the legal position and liability of electric light and power companies.

A very spirited discussion followed the presentation of this report. The main point at issue concerned the committee's criticism of section IV of the National report, respecting specifications for overhead crossings of electric light and power lines. J. H. McDonald was the first speaker. He replied to the criticism embodied in the report by stating that the railroad companies are only interested in the matter of wire crossings as regards safety. He said that it is their policy to co-operate with the electric companies in the compiling of standard specifications. This matter is an engineering problem, and, as many of the smaller companies do not employ engineers, no technical co-operation can exist, with the result that the railroad must protect their interests by rigid specifications.

R. D. Coombs stated that in his opinion the local committee's report was unfair. He held that the first, third and ninth clauses in the National committee's report were objected to on the grounds of being specifications, when, as a matter of fact, they were matters of policy. He said that the National committee endeavored to compile specifications that would appear reasonable to all concerned. He sustained all points of the National committee's report, save that relating to clearance.

H. H. Perkins brought out the point that there is no joint responsibility between railroad companies and electric light companies as regards accidents at line crossings. The electric company is held solely responsible.

J. H. MacDonald said that there are two reasons why the requirements of the railroad company for line crossings are so rigid. The first is that the railroads are on the property first, and feel that the electric companies should meet their requirements in trespassing their property; secondly, as no standard specifications have ever been agreed upon between electric companies and railroads, the latter must take the initiative.

Thomas Sproule discussed the entire report at some length, upholding in a general way the report of the National committee. He defended particularly the specifications referring to the use of 3.5 by 4.5 crossarms and locust pins. He upheld certain of the state committee's criticisms of section II of the National report. Regarding sections IV Mr. Sproule said that the railroad companies are justified in demanding safe construction over railroad crossings. He upheld the National committee's report if applied to voltages above 2,300 nominal. He said that it should be recognized that an extra hazard exists over such crossings, due to the large danger zone that is created when an accident occurs over a crossing.

John F. Gilchrist stated that the engineers of the Commonwealth Edison Company had gone over the report of the National committee very thoroughly and found it satisfactory in every respect. He endorsed the personnel of this committee, saying that it was composed of the highest authorities on this subject obtainable. He thought, however, that undoubtedly, certain objections might be made to several features of the report, due to opposite opinions held by various engineers.

E. H. Davis made a strong plea for a consideration of the legal aspect as brought out in the National report. He said that Pennsylvania courts do not recognize extra hazard, but rule that the highest type of construction should be maintained throughout the entire system. By adhering to the specifications of the National committee regarding line crossings the electric companies would be liable in case of accidents, unless the entire system was installed as over railroad tracks.

After a period of discussion regarding various other minor points, a motion was made to approve the report of the Pennsylvania committee and submit it, together with the discussion, to the committee of the N. E. L. A. A vote of Class A members was taken, the result being 17 to 1 for the affirmative. The meeting then adjourned.

FRIDAY MORNING SESSION.

Friday morning's session was devoted to commercial work, in accordance with which E. F. McCabe, as chairman of the Commercial Section, presided. The opening business was the discussion on P. H. Bartlett's paper on "Service Connections," which was presented at the session on Thursday morning. H. N. Müller opened the discussion outlining conditions in Pittsburgh.

President Granger proposed for discussion four general questions each of which was discussed separately. The first was: should electric light companies introduce service inside a customer's premises, or terminate it outside on a bracket?

E. B. Greene thought that stopping the connection on the outside of the

customer's building at the point of entrance was the best practice. Mr. Franklin explained that there are two operating companies in Easton, and on account of the many customers switching from one company to another, both have established a rule that the customer's wiring should terminate eight feet from the building.

The second question by Mr. Granger was: what is the attitude of the Association regarding the location of meters? F. M. Noecker opened the discussion expressing the opinion that meters should be placed on the outside of buildings, in specially constructed recesses in the walls. In such cases the service lines are then on the outside of the building, accessible to frequent inspection. He said that over seventy per cent of the meters in Renovo are placed outside in this manner.

Mr. Ward held that this method was not adaptable in the larger cities owing to the necessity for periodic inspection. In winter time it would be practically impossible to test the meters if they were placed outside. J. E. Pyle explained that in West Chester all service lines to meters are run in concealed conduit so that no tampering can be done.

G. E. Wendle inquired of Mr. Noecker how many meters it was possible for a reader to read in a day by having meters installed outside, and also if any bad effects were noticed, due to weather conditions. Mr. Noecker replied that the meters he referred to have been installed outside for over eight years with no bad effects; also a man is able to read 300 meters per day as compared with 90 or 100 when installed inside. Referring to a previous point made, that the weather would seriously interfere with testing when placed outside, Mr. Noecker said that inspection should be so arranged that meters installed in commercial institutions, buildings, etc., could be inspected during the winter months, and outside meters at other times.

E. B. Greene claimed that periodic testing was becoming more and more necessary, and that no definite time would be designated for inspection and testing of the various meters. He thought the best place for the meter was at the nearest point to the rear entrance of a customer's premises, inside the building.

The third general question was: should the companies install and own all connections up to the house side of the meter? E. H. Davis answering this, thought that even under these conditions the customer could not be prevented from tampering with, or interfering with, his own property.

The fourth question asked for opinions as to whether the paper as a whole was of sufficient importance to justify an appointment of a separate committee to consider the subject. Thomas Sproule held that this subject is one of the most important affecting central-station new business, and he recommended that the paper be referred to the Executive Committee for further consideration. This recommendation was made into a motion and carried.

The paper by E. B. Greene, entitled "Electrical Appliances," was then taken up.

ELECTRICAL APPLIANCES.

This paper outlines briefly the advantages of pushing the sale of electrical appliances and mentions a few incidents, in regard to their introduction, that happened in Altoona.

The value of electrical appliances to the central station has been looked upon by many with suspicion. There are a number of people, no doubt, who feel that the cost of getting these small current-consuming devices on the lines is too high when compared to the annual revenue. Many factors enter into this problem, one of which is the rate of charge for domestic consumers of electricity. Mr. Green is a strong advocate of a two-rate system of charge, the high rate for that which would be equivalent to one or more hours' use of current per day, and the low rate for all current consumed in excess of this amount, *i. e.*, if a residence is equipped with a connected load of ten sixteen candle-power lamps, the first seventeen kilowatt-hours consumed per month should be charged for at the high rate, and all current consumed in excess of this at the low rate. In analyzing the amount of current sold, it has been the writer's experience that the average consumption of all residences added together is equivalent to one hour's use of current per day (not including appliances), and this is invariably on the peak. Now, if this amount of current consumed could be doubled, by inducing the customer to use electrical appliances, fully fifty per cent of the then used current would be off peak, and all the revenue secured from these sales means off-peak revenue. It is the author's honest conviction that the prices for current from central stations should be lowered to the point where the income will maintain the property, pay all fixed charges, all operating expenses, and a fair dividend to its stock-holders; it has been the writer's experience that when this is done the net income is greater, and the business more satisfactory, the further the reduction.

Mr. Swayne explained in more detail the campaign for electric appliances, particularly flat irons, carried on in Altoona. After a very brief campaign, 2,460 electric flat irons, and 472 toaster stoves were sold. Supplementing advertising, the company secured a number of high-school boys to solicit business, offering fifty cents for each iron or toaster sold. This method was found to be very satisfactory.

Mr. Shute spoke of another phase of electric appliance business in Altoona, namely, the encouraging of customers to loan their flat irons to non-users. This has had a very good influence on increased business, and many houses without wiring, were signed up, principally on account of the flat irons. He referred briefly to the question of rates, saying that after all when a customer is convinced of the merits of the electric flat iron and its advantages over the older methods, the cost of operation is insignificant.

J. M. Cole explained the effect of the flat-iron load in his locality. On Tuesday mornings it is very frequently necessary to employ an extra man in the boiler room, and it is also necessary, on some Tuesdays, to cut in an additional generating unit.

Mr. Warfield spoke against the employment of high-school boys as solicitors, saying that in their endeavor to make as many sales as possible, they will misrepresent the appliances, and consequently make enemies for the central station.

The paper entitled "Central-Station Service versus Isolated Plants," by T. E. Spence, was then taken up, and, in the absence of the author, was read by W. C. Anderson.

CENTRAL-STATION SERVICE VERSUS ISOLATED PLANTS.

This paper sets forth, briefly, the general trend of ideas advanced in favor of purchased power, endeavoring to show that the question of costs should not always be the deciding factor, but that the many contingent, or rather, accruing, advantages are largely in favor of the central station, and should be given due consideration in balancing the central-station supply against the isolated plant. The average manufacturer, or merchant, has not sufficient training to intelligently decide on the comparative merits of central-station service and service from an isolated plant. Occasionally a manufacturer is dealt with who has the technical knowledge, but, as a rule, it is impossible for him to give this question the necessary time in order to arrive at a satisfactory conclusion. Therefore, in the majority of cases, it is necessary for the manufacturer to employ the services of an expert to do this work, or depend upon the statements of the central-station solicitor, who it is presumed has made a careful analysis of the load, thereby enabling the furnishing of a reasonably accurate estimate of the cost of central-station power. In either event the central-station solicitor must quickly and clearly grasp the essential points of the case, and present them with such clearness and force as to compel the acceptance of his proposal by the prospective customer. Great advances are being made in the art of long-distance transmission; the efficiency and size of the steam turbine has been improved; also, the gas

and oil engines have been developed. Power plants have been improved in arrangements providing for economy of space and labor, on the whole materially reducing the costs of power production. In order to keep pace with the advancement of the art, the central station is forced to install up-to-date apparatus. On the other hand, the manufacturer cannot readily afford to replace his machinery for newer types, as his power is more or less a smaller consideration, and because of the money involved, it is the usual method to use the isolated plant continuously until it is relegated to the scrap heap. A further difference between a small plant and a central station is that there is greater flexibility of service when energy is supplied from the central station. A manufacturer never knows how future trade conditions will affect his business. It may increase extensively, and, in order to keep pace with its growth, it will be necessary to install additional units, which usually results in a very undesirable type of plant, which is less efficient, and needs more attention, more repairs, etc. If his business decreases, then he will suffer by reason of fixed charges. If a fire destroys a part of the factory, it matters not if it be power plant or factory itself, the business of the factory is sure to suffer a heavy loss because no insurance company will compensate the business loss. The insurance company will compensate you for the cost of the building and the machinery perhaps, but not for the stoppage of business. Annoyance of smoke, dirt, heat, odor, etc., is absent from the factory purchasing electric power, hence the working efficiency of the employees is increased by the additional comfort. The necessary detail work of purchasing and maintaining a stock of fuel and general power plant supplies, which is not generally considered an item of cost in the moderate-sized plant, must be borne by the factory with its own generating plant.

E. B. Greene opened the discussion, saying that while his station supplied a total of 4500 horsepower to various coal mines, this was done only in cases where there was not a sufficient water supply at the site of the mine. Mr. Kinney said that his company supplies any number of mines in a large soft-coal district where any quantity of water is available, but where the mine operators appreciated the advantages of central-station service.

H. N. Müller brought up the point of the opposition of consulting engineers to central-station service, as against isolated plants. He also referred to instances in Pittsburgh where isolated plants had been closed down and central-station service substituted on account of the smoke nuisance attending the former. Mr. Robertson called attention to the illuminating-engineering argument in favor of central-station service. By proper illuminating methods, with the use of tungsten-filament lamps the current used can be considerably reduced. In the case of an isolated plant this simply reduces the coal bill, whereas, if buying current from a central-station company, the entire power bill would be reduced.

Following this, the Nominating Committee made its report, submitting to the Association the following nominations for officers for the ensuing year: president, R. S. Orr, Pittsburgh; vice-president, Van Dusen Rickert, Pottsville; secretary-treasurer, Walter E. Long, Philadelphia. The new members of the Executive Committee are: E. H. Davis, D. T. Campbell and S. C. Pohe. The secretary was instructed to cast the ballot of the association for these officers. Mr. Orr then made a brief address of acceptance, thanking the members for the honor they conferred upon him. Various resolutions, thanking the various committees for the work they had done, were presented and passed.

Continuing the regular program the paper by C. E. Stephens, entitled "Ornamental Street Lighting," was taken up. An abstract of this paper will be given in a later issue.

ENTERTAINMENT.

The entertainment features were most enjoyable and the committee having the arrangements in charge is certainly deserving of credit for the admirable manner in which all events were carried. Wednesday morning card games were played by the ladies. Wednesday afternoon was devoted to athletic events. Preceded by a band, the entire delegation marched from the hotel to the exposition race track where the meet took place.

The first event was a fifty-yard dash, this being followed by a 100-yard dash, sack race, three-legged race, fat-men's race and horse race. The affair was concluded by an exciting ball game between the supply men and central-station men, the score being a tie. Handsome prizes were given the winners in all events, these being donated by the manufacturers. The day's enjoyment concluded with a theater party and minstrel show for which excellent talent was secured.

Thursday morning and afternoon the ladies were entertained by drives, boat rides and porch games. In the evening a bowling tournament and rifle contest was held. An informal dance and party at 8 o'clock, followed by a rejuvenation of the Sons of Jove, concluded the program. About thirty-six were initiated into the Order.

Friday morning the ladies held a bowling tournament and rifle contest, followed in the afternoon by a fishing contest and boat race. In the evening an impromptu musicale was held.

EXHIBITS AND MANUFACTURERS' REPRESENTATIVES.

While the registration of manufacturers and supply men was large, very few exhibits were maintained. The General Electric Company, exhibited in the rear of Convention hall, a complete line of heating and cooking devices, Mazda lamps of all sizes, an electric range, meters, transformers, etc. Among those in attendance were: J. M. Hayes, John Hamilton, W. H. Cogswell, C. A. Raymond, W. H. Rue, W. L. Mason, E. W. Howard, J. J. Lills, T. E. Gordon, J. E. Hill and C. C. Supplee.

Directly across from this exhibit was the display of the Simplex Electric Heating Company. A complete line of cooking utensils, flat irons, etc., was shown. The company was represented by E. B. Stebbins.

W. N. Matthews & Brother, of St. Louis, exhibited Matthews explusion-type fuse switches for pole mounting, two-bolt clamps, guy anchors, hold-fast lamp guards and a complete line of specialties. V. L. Crawford was in attendance.

The Pittsburgh Transformer Company, of Pittsburgh, Pa., made a very interesting exhibit of various types of transformers, series street-lighting systems, fuse blocks, etc. The company was represented by H. G. Steele.

Hubbard & Company, Pittsburgh, Pa., exhibited hinged arms for tungsten street lighting, arc-lamp hooks, insulators and miscellaneous supplies. C. L. Pierce, Jr., represented the company.

The Westinghouse Electric & Manufacturing Company chartered a steamboat, the *Helena*, upon which its exhibit was placed and which was at the service of the convention for rides on the lake at any time. The boat was decorated with incandescent lamps, the decorations including a keystone outlined in lamps. The exhibit included electrically heated apparatus as follows: Chafing dishes, small travelers' pressing irons, toaster stoves, coffee percolators, domestic irons—several sizes, automatic tailors' irons, luminous and non-luminous radiators, glue pots, heating pads, nursery milk warmer and water heater, physicians' and dentists' sterilizer, switchboard voltmeters, portable lamp-tester's volt-wattmeter, single-phase watt-hour meters, four sizes of small lightning arresters, fan motors and transformers. Moonlight rides were given each night of the convention and on these rides refreshments

were served by the use of some of the electrically heated cooking utensils which formed part of the exhibit. On Wednesday night 165 persons were served within a space of one hour. The refreshments consisted of egg, ham and club sandwiches, chicken a la King and coffee. One toaster stove fried four pounds of bacon, another toaster stove toasted 180 slices of bread, two chickens were prepared in one chafing dish, and coffee was served to the party from two percolators. The Westinghouse interests were represented at the convention by the following: J. C. McQuiston, T. F. Foster, W. Barnes, Jr., L. L. Warfield, C. E. Stephens, S. A. Fletcher, W. B. Underwood, T. J. Pace, T. A. McDowell, A. M. Dudley, W. F. Fowler, John Andrews, Jr., G. H. Criss, W. B. Wilkinson, M. M. Barr, L. A. Starrett, W. G. Miles, J. M. Ireland, H. M. Gansman, M. C. Morrow, V. E. Cohen, L. T. Peck, and B. F. Fisher, Jr.

Among other manufacturers and supply men in attendance were the following:

C. L. Pierce, Jr., Hubbard & Company; W. H. N. Ward, Philadelphia Electrical & Manufacturing Company; R. H. Smith, Crocker-Wheeler Company; Fred C. Jaeger, Howard H. Jaeger, Joseph Sigg, Western Electric Company; R. J. Smith, J. A. Roebling's Sons Company; W. M. Winship, H. T. Paiste Company; W. A. Williamson, Federal Sign System (Electric); E. Kerschner, Standard Underground Cable Company; Benjamin Wall, The Wall Winn Company; C. B. Cushing, National Metal Molding Company; J. S. Connell, Frank H. Stewart Electric Company; W. C. Robinson, H. C. Owen, Western Electric Company; Wm. L. Loeb, Excess Indicator Company; R. M. Morris, Safety Armorite Conduit Company; W. F. Ficklen, Crocker-Wheeler Company; J. S. Rogers, Western Electric Company; John Mustard, C. F. Succop, Wagner Electric & Manufacturing Company; Wesley White, General Vehicle Company; W. J. Kline, American District Steam Company; J. B. Nicholson, Allis-Chalmers Company; E. C. Owen, Miller Owen Electric Company; L. R. Jeffords, Art Brass & Fixture Manufacturing Company; Nathan Shute, Ohio Brass Company; W. A. McCombs, Pittsburg Pole Reinforcing Company; G. I. Barry, The Buckeye Electric Company; W. O. Dale, Philadelphia Electrical & Manufacturing Company; Elliott Reynolds, Doubleday-Hill Electric Company; C. B. Price, Western Electric Company; Paul C. McCutcheon, H. N. Voorhis, H. W. Johns-Manville Company; F. C. Foster, H. D. Porter, Buckeye Electric Company; T. E. Mansfield, Holophane Company; C. H. Johnson, Eureka Vacuum Cleaner Company; D. W. Eyman, Bryan-Marsh Company; R. W. Jaynes, American Conduit Manufacturing Company; R. W. Sullivan, Federal Sign System (Electric); F. H. McDowell, National Carlinto Company; J. O. Staniek, Crocker-Wheeler Company; J. W. Smyth, Frick & Lindsay Company; C. R. Bishop, American District Steam Company; M. L. Zaher, Cleveland Electric Supply Company; M. J. Kiefer, Crouse-Hinds Company; J. M. Smith, Buckeye Electric Company; S. H. Payne, Allis-Chalmers Company; T. E. Reger, Elliott Lewis Company; Harry M. Raphael, Raphael Electric Company.

MAKING THE OUTSIDE BRIGHT.

BY RALPH BEMAN.

The standard of illumination has been so raised in interior and street lighting that we view with little surprise increased expenditure for lighting streets and buildings beyond the absolute requirements. In the main, this work has been confined to business districts where a well illuminated street

OUTLINE LIGHTING SUPPLEMENTED BY SIGN.

possesses an advertising value, which the merchant soon realizes, where there is opportunity for comparing the popularity of the brilliantly lighted street with the dark and forbidding highway. We have witnessed the replacing of single arc lamps on the street corners, and perhaps one or two between, by

ELABORATELY LIGHTED FACADE.

ornamental standards carrying a group of high-efficiency incandescent lamps so arranged that their standards and inclosing globes are an ornament to the street viewed either by day or by night.

Not content with drawing the prospective customer into his district by the hypnotic influence of the lighting, the merchant has used the same means in attracting the attention of the prospective buyer to his goods by means of a brilliant illumination in the show windows. As it is the goods which have to be presented to the purchaser, the progressive merchant sees to it that they are shown off to the best advantage. This frequently requires almost a flood of light, especially as each dealer must not fall behind his neighbors in the matter of illumination, for fear that his establishment will look less progressive and prosperous than those of his rivals. Nor may the store-keeper stop here; his customer, attracted by the goods tastefully displayed in the window, must not be disappointed when he crosses the threshold about to make his purchase. Again a sufficient amount of light must be available to make the place cheerful and attractive.

It would seem that nearly every step between attracting the buyer and completing the sale should be assisted by an ample illumination. We may, therefore, not be surprised to find electric lighting used to make the place of business or building conspicuous from afar, even farther than the beautiful street lights can project their influence.

This at once suggests electric signs, and there are signs and signs. Fortunately the tendency is to get away from the cruder and less artistic forms, which have called forth so much criticism, and instead utilize the great possibilities of the small electric sign lamp for producing effects as truly beautiful as many electrically formed pictures which we so admire on the stage. The unfailing attraction of objects in motion is often utilized by employing flashed signs in which figures go through surprising movements at the command of a small flashing mechanism which again and again repeats its series of motions without attention. Many of these signs are not what we would consider a dignified method of advertising certain lines of business, but the stationary or fixed signs have a character of their own which makes them suited for such purposes as keeping before the public mind the name of a bank, hotel, office building, or railroad.

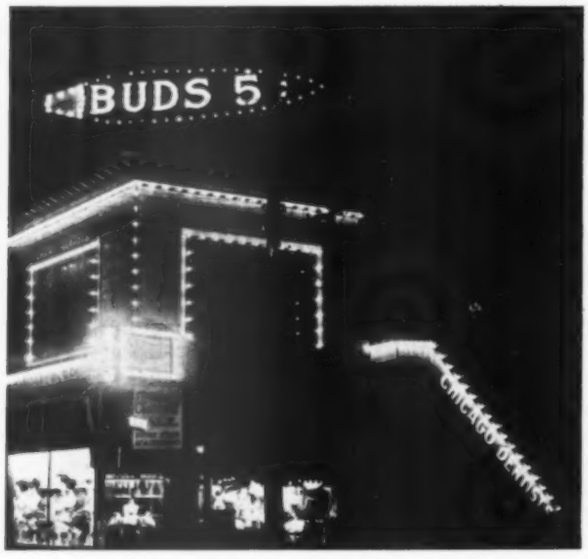
The owners of buildings often realize that it is desirable to give their particular property as much favorable publicity as possible, but the means at hand

are somewhat limited. Where it is the building itself that must be advertised, it is natural that electric lighting, which is called in to assist in this work, should be so designed as to bring out or make conspicuous the form and location of the structure. This may be done in a variety of ways.

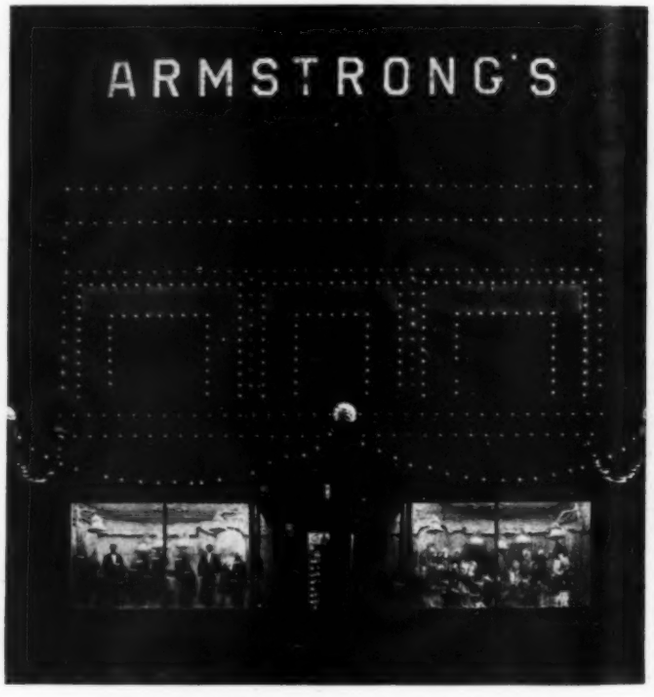
Some kinds of building fronts may well be made in strange and wonderful forms and covered with dozens of brilliant lamps, so that the observer from mere curiosity casts his eye in the direction of the light and marvels at the odd shapes and effects which he beholds. The moving picture show or penny arcade profits by displaying a spectacular appearance so that its gorgeous facade is in keeping with the purpose to which the building is devoted.

Of a more dignified character, and better suited to advertising the sterner forms of business enterprises, is the outlining of the building and its architectural features. This is ordinarily accomplished by means of small lamps placed somewhat closely and arranged in long rows or strings. The lamps are to serve merely as points of light, hence are usually of small candle-power and have clear bulbs. The lamps must be used in sufficient number to give the impression of a continuous string, but need not be closer together than this requirement dictates. In fact, where the lamps are to be viewed from a distance, as when located on the top of a high building, the spacing can be rather liberal. Fortunately the cost of operating a large number of lamps in this way has been very materially reduced through the introduction of the Mazda sign lamp, which has been successfully used for this purpose on both direct and alternating-current circuits. The efficiency of this lamp is so high that we can have a spot of light, such as is given by a two-candle-power light source, with an expenditure of energy of only 2.5 watts.

EXTERIOR LIGHTING OF A SMALL BUSINESS.



OUTLINING AND ILLUMINATING THE SURFACE.



OUTLINING COMBINED WITH SIMPLE SIGN.

The use of small lamps in outline work is intended, as the term implies, to show merely the form or outline of parts of the building. It is but one step further to employ lamps of such power and number as to cast an appreciable amount of light on the actual structure, walls, window casings, cornice and the like. The surfaces lighted are seen by the light they reflect. The modern glazed terra-cotta building materials make efficient reflectors so that an entire store front so constructed can be brilliantly lighted with a very reasonable expenditure for current. For this purpose carbon lamps should not be used, as the white light from high-efficiency metal filaments makes the most attractive display in conjunction with the polished white wall.

The methods of installing the lamps vary with the particular problem in hand. Sometimes it is possible to design a building lighting equipment before the building is started, so that provision can be made in the wall for the necessary outlets. In such cases, the lamps may well be used to supplement the designs of the architect, and bring out to the best advantage the ornamentation which otherwise would be largely lost on account of being invisible and unnoticed most of the time. Where the building is already completed, it is frequently possible to place rows of lamps across the front in a trough-like reflector, which will illuminate the walls for one or two stories above and below the lamps. For this purpose, lamps of the 25 or 40-watt sizes may be used, being placed somewhat close together to provide a rather high intensity of illumination.

Exterior fixtures are becoming more and more evident for buildings of all sizes. We rather expect the hotel and restaurant of the higher class to have

beautiful and elaborate brackets or standards on either side of the entrance, but somewhat less usual are smaller fixtures installed in front of drug stores, candy shops and other establishments sought by the crowds in search of refreshment. More elaborate attempts with the somewhat larger buildings provide numbers of torch-like fixtures, often fitted with large glass globes containing one or more high-efficiency lamps. These shed their light on the street and walls of the building, adding to the general brightness of the neighborhood. Sometimes fixtures of this kind are located on the walls not far from the roof, calling attention to the building from a considerable distance.

If the surface of the building alone is the object to be brought forth by artificial illumination, the light source

EXAMPLE OF EXTERIOR LIGHTING.

may be concealed. The methods applying to illuminating billboards may be used also in this service. High-candlepower lamps in powerful reflectors are sometimes located at about the height of the roof, on poles which extend out from the building so that a large amount of light may be directed upon the upper stories. The lower stories are frequently quite brightly illuminated by the street lamp and the diffused light from show windows; therefore, the special lighting is usually concentrated on the upper part of the building where it may serve best to bring the building into prominence when viewed from a considerable distance. In the case of "skyscrapers" the advertising value depends upon the building overtopping all its neighbors, and this fact can best be made evident by some method of exterior lighting, especially if the offices in the building are not lighted in the evening.

While we are elated at the progress which has been made in improving lighting conditions both in interiors

TYPE OF OUTSIDE FIXTURES.

and on the street, we should not forget that the possibilities for a wise expenditure for improved lighting are by no means exhausted. Lighting the outside of a building as well as the inside is but one of the modern methods of making artificial light serve our numerous and varied needs.

Electrolysis of Underground Pipes.

An interesting paper was recently read before the Engineering Society of Western Pennsylvania describing troubles due to electrolysis of the underground pipes of gas, electric light, telephone, telegraph and water systems of Pittsburg caused by stray electric currents from the return circuits of the street railway system. The paper describes very carefully the methods taken to show that the trouble was due without question to stray electric currents and then proceeds to outline the methods followed in determining the relative electrical condition of the rails and underground pipes throughout the whole city.

The authors considered that there were six more or less prominent methods of mitigating electrolysis troubles: (1) The double-trolley system. (2) The return-pipe feeder system. (3) Use of alternating current. (4) Insulating the joints of the pipe lines. (5) Coating all underground structure with a non-ionizable coating. (6) The bonding of all rails as return feeders.

The system used in Pittsburg was the return-pipe feeder system, the rails being cross-connected to the pipes at frequent intervals, using very heavy conductors. This method was found to reduce the trouble almost to a minimum when a sufficient number of cross-connections were made. This, however, proved a very expensive method of removing the trouble. At the same time the authors of the paper expressed themselves as of the opinion that corrosion was still proceeding, although the rate of deterioration seemed to be too slow for detection, and would probably not be sufficient to injure the pipe during its natural life.

Considerable criticism of this method

EXTERIOR OF AN AMUSEMENT HALL.

of remedying electrolysis was expressed in the discussion which followed. A. F. Ganz believed that the Pittsburg system was wrong both in principle and practice, and stated that the authors had not even mentioned the one particular system which has received almost universal recognition and which is the only one with a correct theoretical foundation, namely, the radial insulated-return feeder system. He instanced the recent troubles in Winnipeg which resulted in all bond connections to underground structures being removed and the radial system of insulated return feeders being installed, which drain the rails of current so that there is practically no trouble to underground pipes.

Industrial Power

THE FIXATION OF ATMOSPHERIC NITROGEN—II.[1]

BY JOHN WOODS BECKMAN.

THE NITRIC-ACID OR AIR-SALTPETER PROCESS.

Priestley, the philosopher, found as early as 1775 that if he produced electric sparks in air and treated this air with water he would have a dilute solution of nitric acid. Not many years after Cavendish produced saltpeter by treating the air through which electric discharges had taken place with lye from wood ashes.

The primitive electric apparatus in use at that time, and its comparatively slow improvement and development up to a few years ago, caused these discoveries to remain commercially valueless. It is only within the last fifteen years that the factors bearing on the question have been sufficiently developed to make it possible to grapple satisfactorily with the problem of fixing atmospheric nitrogen and oxygen in the shape of nitric acid.

It is only within recent years that electric power, generated in enormous quantities, has become comparatively cheap. Large units of machinery have been installed for the production of power. Perhaps more than anything, the characteristics of phenomena of such complex nature as the electric arc have been studied in a manner such as could not have been in the days of Cavendish and Priestley with their minute arcs. But it is not only the increased knowledge of electric phenomena and the practical way of handling power that have advanced this industry; perhaps more potent than either of these is the advance in theory, in science and in the knowledge of the laws governing gases, together with a fuller appreciation of the law of mass-action, besides other laws of physical chemistry.

The names of Lovejoy and Bradley will go down in chemical history together with those of Priestley and Cavendish. Lovejoy and Bradley were the first to apply power of some magnitude in the manufacture of "atmospheric products." Some ten years ago they formed "The Atmospheric Products Company," whose purpose was making nitrates and nitric acid in a manner identical to that of Priestley 125 years before, only, in 1775 the power available was small indeed as compared to the power available to the Atmospheric Products Company By means of a series of arms rotating inside of a closed vessel innumerable little arcs were intermittently produced between small platinum contacts placed at the end of the arms and on the wall of the vessel. A current of air was passed through the apparatus and the nitric oxide formed was absorbed. The faults with this system were its complexity, its initial cost and cost of upkeep. An interesting feature of it is that Lovejoy and Bradley produced per kilowatt-hour the same amount of nitric acid as the system at present in use by the Badische Anilin and Soda Fabrik. It was soon found that the process was not economical and in 1904 the factory which was installed at Niagara Falls was closed.

At the time when the factory at Niagara Falls closed its doors a new system for the fixation of nitrogen had been developed by a Norwegian professor, Dr. K. Birkeland. The system was new in that the arc was formed in a new manner. Instead of having a great number of small arcs Professor Birkeland used a large arc which was spread out by a magnetic field. Through this arc the air was passed and during the time of its passing the oxygen and nitrogen combined.

In succession follow the Schönherr process, the Pauling process and a number of others, among them Guy's process which has been kept a profound secret.

When air is treated for the production of nitric acid the product obtained is the oxide of nitrogen, according to following formula:

$$N+O=NO.$$

At every temperature to which the gases present in the air are submitted, there is a continuous forming and reforming of nitric oxide and an equilibrium is maintained such as when a pair of scales equally laden swings back and forth. The higher the temperature the higher is the per cent of nitric oxide formed and it is on this account that the greatest heat source available—the electric arc—is applied in all processes used for making nitric acid from the atmosphere. All the processes being alike in this feature it is only in the practical application of this principle that they are to be differentiated.

The greater the temperature the greater the concentration. Should the gas mixture containing nitric oxide be gradually cooled off, permitting the gas to accommodate itself to the different temperatures, in the end there would remain only the amount of nitric oxide corresponding to the equilibrium at the final temperature; but in case the cooling is very rapid, so as not to permit the gas to accommodate itself to the intermediary temperatures, a higher concentration of the nitric oxide is obtained than that which corresponds to the temperature at which it has been cooled.

This is the greatest problem to be solved and the process that can bring the gas mixture down to the lowest temperature in the shortest space of time will be the one most valuable commercially.

The gas emitted from the combustion chamber is a mixture of nitric oxide (a small per cent, varying from 2.5 per cent to 1.5 per cent, according to the process), oxygen and nitrogen. The nitric oxide reacts with the oxygen, forming nitrogen peroxide according to the following formula:

$$NO+O=NO_2.$$

This product is really a mixture of various oxides of nitrogen, and has to be absorbed by water to form nitric acid according to following formula:

$$3\ NO_2+H_2O=2\ HNO_3+NO.$$

The NO thus obtained unites again with oxygen and forms peroxide of nitrogen, and the absorption goes on still further. In actual practice, the question of absorption is not quite so simple, as there are a number of different reactions due to other oxides present.

1 Separately copyrighted. All rights reserved.

Nitrous acid is formed but is unstable, and decomposes at an ordinary temperature, forming nitric oxide and nitric acid.

The acid formed is quite weak and has to be concentrated by evaporation. This is easily done by making use of the excess heat evolved by the arc.

The product most generally made for fertilizer purposes is the basic nitrate of calcium. The "air-saltpeter," as it is called, is obtained either by treating milk of lime with the gases or by treating the carbonate of lime with the dilute acid obtained. A solution of the salts will be the result. A slight excess of lime is added to the solution, which crystalizes after evaporation, forming basic calcium nitrate which is slightly less deliquescent than the normal calcium nitrate. When the salt is made with milk of lime a considerable per cent of nitrite is present which is supposed to have increased fertilizer value on account of its containing 18 per cent of nitrogen while the calcium nitrate contains but 12 per cent of nitrogen.

It is evident that the conversion of atmospheric nitrogen into nitric oxide is a complicated problem. Dr. K. Birkeland (a professor in the University of Christiania) was the first to solve it commercially. He built a furnace in which an arc, produced between two water-cooled copper electrodes, was deflected by means of a magnetic field into the shape of a thin disk through which air was passed, thus forming nitric oxide.

For several years the Birkeland and Eyde furnace has been operated at Notodden, Norway, and though for a time the Schönherr furnace took its place, it has recently been re-installed. The Norsk Hydro-Elektrisk Kvaelstofaktieselskab owns the patents for the furnace. The company is closely allied with the Badische Anilin and Soda Fabrik, which own the patents for the Schönherr furnace. These companies are at present developing a considerable amount of power, and such an affiliation has made it possible for them to make use of what is best in the two systems, at these new installations. They contemplate carrying on some comparative tests between the two types of furnace in order to determine with still greater accuracy the commercial value of each.

The Birkeland and Eyde furnace is undoubtedly more complicated in construction than others. This defect is to a great degree counterbalanced by its excelling them in flexibility.

The Badische Anilin and Soda Fabrik of indigo fame, situated in Höchst am Main, appreciated the importance of fixing atmospheric nitrogen and started to make experiments along those lines in the latter part of the last century. In 1905 Schönherr, together with an electrical engineer, discovered an exceedingly simple way of burning the air in an electric furnace. This proved to be so easily operated that it now seems likely to become one of the world industries.

After considerable experiments, Schönherr found that by forcing air in a helical path through a tube he could produce an arc which would burn steadily and indefinitely. In this way the arc is drawn out to any length, depending upon the voltage used. At present the voltage used is 5,000 volts and a twenty-three-foot arc is obtained that burns as steadily as a candle. Nearly the entire length of the combustion tube is surrounded by three concentrical chambers. The outer one leads the hot gases containing the nitric oxide down along the "fresh-air" chamber and out into the gas mains from whence it goes to the absorption towers. So the incoming air is preheated by the treated air, thus providing a comparatively quick cooling device for the gas and obtaining a high per cent of nitric oxid. The fresh air also is heated while passing through the inner chamber by coming into contact with the tube in which the arc is playing. By such an arrangement the tube is prevented from getting overheated and a great heat economy is obtained. The mechanical devices employed for starting the arc are exceedingly simple and the whole apparatus is one of utility and durability. The combustion tube is practically indestructible and the other parts of the apparatus (such as electrodes) are of such construction that they can be replaced at a minimal cost if they burn out.

It is unnecessary to expatiate further upon the constructional details of these furnaces,[2] for descriptions of them have already appeared in various publications.

After leaving the furnace the gases go through specially constructed boilers where steam is generated which is to be used later in concentrating the product. From the boilers the gases pass through large granite towers where the oxidation and absorption go on.

In Norway the Birkeland and Eyde furnaces have been superseded by the Schönherr furnace which has been growing in size until it has reached astonishing dimensions. The Norwegian Company, associated with the Badische Anilin and Soda Fabrik, has developed 135,000 out of 250,000 horsepower for the purpose of making nitric acid and nitrates. The furnaces originally installed in Norway were built for some few hundred horsepowers; at the new plants 4,000-horsepower furnaces only will be used. Naturally the larger the units (providing no unforeseen difficulties enter) the smaller will be the cost of operating and the greater the economy.

The Pauling Brothers of Cologne, Germany, have practically duplicated Priestley's experiment of 125 years ago with the advantage of dealing with modern electrical conditions. By means of auxiliary electrodes (when necessary) an arc is formed between two horns which are shaped somewhat like horn-gap lightning arresters. The air is then blown in a stream between the horns carrying the arc up with it and elongating it until it is like a large flame. A cold current of air containing some nitric oxide is blown into the upper part of the flame. It will be noted that this cooling arrangement somewhat dilutes the nitric oxide produced by the arc, which accounts for its seeming to be less efficient than the Schönherr furnace.

The appliances of the Pauling furnace appear still simpler than those of the Schönherr. A two-chambered brick tower with inlet and outlet canals in its walls constitutes the furnace. An arc plays in each chamber and the burnt air passes through an outlet canal into the mains from whence it is carried through a preheater into the absorption towers.

The furnaces are single phase and are operated on a 6,000-volt circuit, giving a fairly good voltage curve. The two arcs in the furnace are connected in series. The Pauling furnaces have been of comparatively small size, but lately at a plant in France equipped with these furnaces they have installed such, taking 1,000 kilowatts.

The financial success of any of these methods is altogether dependent upon

2 These furnaces are single phase, and operate under peculiarly steady voltage. The voltage curve is practically an ideal sine curve.

the cost of power. In Norway it can be obtained at $5.00 per horsepower-year. The cost of binding one kilogram of nitrogen there is fifteen cents. The cost of power—five cents—is included in this. The remaining ten cents covers such expenses as overhead charges, fixed charges, depreciation and labor.

$15 per horsepower-year is a figure at which power can be obtained at Niagara Falls. Under these conditions the cost of binding one kilogram of nitrogen would be about twenty-five cents. Nitrogen in shape of Chilean salpeter sells at about thirty cents per kilogram; thus a profit margin of five cents per kilogram or $50 per metric ton would be left. These figures are all merely indicative. Power may be obtained at a lower price and on the other hand labor may be a little higher in price but the foregoing statement gives a striking proof of the important role the price of power plays in the economical burning of nitrogen for fertilizer purposes.

The most striking advantage that the air-saltpeter process has over others is that the raw materials used cost nothing, that they are abundant and that they need no treatment to make them usable. To produce saltpeter, nitric acid is bound with lime and as lime can be obtained at a very low figure the process as far as raw materials go is very cheap. Another point strong in its favor is that humanity is not robbed by it of necessities. On the other hand the limenitrogen process has the opposite tendency; the earth's store of coal which is one of the most important mineral deposits and upon which the welfare of humanity rests, is depleted by every ton of limenitrogen produced because one of the two components of the carbid used is carbon.

The operation of the furnaces is simple, for the arcs once started require no more than casual attention, thus doing away with a great deal of labor. Also, the inexpensive upkeep and the comparatively low initial cost, are factors that speak strongly in favor of the process.

Even though the nitrogen content is lower, air-saltpeter has a better fertilizer value for certain crops (such as tobacco) than has Chilean nitrates, because the chlorides usually present in the latter are not to be found in the former.

One of the greatest drawbacks to the process is the low chemical efficiency of the arc (amounting approximately to only 3 per cent), but this defect is balanced in part by the good heat efficiency.

The low concentration of the nitric oxide and the complexity of all the different oxides of nitrogen formed by polymerization, etc., complicate the chemical end somewhat, and make it practically impossible to obtain pure nitrate if the gas is absorbed in milk of lime. If the gas be first absorbed in water and if this water be treated afterwards with limestone, a pure nitrate of lime is obtained. Like Chilean nitrate this salt is deliquescent and is liable in moist weather to make the fertilizer mixture cloggy so that it will not pass readily through a drill. This trouble has been in part overcome by using a basic nitrate.

In the air-saltpeter process a comparatively small amount of nitrogen is bound per kilowatt-hour. The Schönherr furnace binds 17 grams of nitrogen in the form of nitric acid per kilowatt-hour; while the limenitrogen process binds 65 to 75 grams of nitrogen per kilowatt-hour.

The comparative values of the different air-saltpeter furnaces are evidenced to some extent by the following table:

	Grams of HNO_3	Concentration in Per Cent of NO (by volume)
Schönherr furnace	75	2.5
Birkeland furnace	70	2.0
Pauling furnace	60	1.0-1.5

This table is not quite fair to the Pauling furnace, for, although it gives the concentration of the gas emitted, still it does not take into consideration that the gas has been diluted by the system of cooling in use.

OTHER PROCESSES.

Under favorable circumstances very nearly all metals will unite with nitrogen, and this fact has given rise to various ways of producing ammonia; for if the nitride be heated with steam, ammonia will be formed. Such a process would be very desirable, if there were any means of avoiding re-reducing the metal from its oxide, formed during the reaction with steam. This insurmountable obstacle accounts for none of these processes having been commercially feasible.

To avoid the necessary re-reducing of the metals, recent experiments have been tried, such as heating titanium oxide with carbon and nitrogen simultaneously, a titanium-carbonitride being the result. Practical difficulties have been encountered carrying out this process, which has gone no further than the laboratory. A similar process has been developed, using aluminum oxide instead of titanium oxide. They all look attractive enough on paper and on a small scale, but the financial side is not satisfactory.

The most promising of all these so far uncommercialized processes is one developed by Haber. Its interesting feature is that it does not depend upon electric power for its operation. Together with his co-workers, he found that nitrogen and hydrogen would combine under pressure and a raised temperature. This reaction is very slow, but with a catalytic agent present in the gas mixture, the speed of reaction is materially increased. Uranium and osmium have been found to be efficient catalyzers, and now this process is only waiting for a cheap method of producing hydrogen, when it will no doubt come to the front.

CONCLUSION.

"In the evolution, growth and creative processes of nature, next to water, the most powerful factor is nitrogen; how to fix and control it is the problem, how to store it is economy, and the knowledge how to successfully utilize its inexhaustible resources produces wealth."

These words, said before the time of Liebig (the greatest agricultural chemist, who died in 1873) were uttered by a German scientist named Schultz-Lupitz, who may be considered the originator of agricultural chemistry. The nitrogen problem is growing more actual every day, and the words quoted above have a deeper meaning now than ever before. But one fact of paramount importance must never be lost sight of; in binding nitrogen for fertilizing purposes, the earth's rapidly decreasing coal deposits should not be encroached upon and made use of, even though it be to the advantage of a substance of equal importance to humanity. Peter must not be robbed to pay Paul—such a management of affairs is not in accord with the conservation of natural resources.

The fixing of atmospheric nitrogen is yet in its infancy. Although already a huge industry, its processes are still young and crude compared with what we have a right to expect them to be a score of years hence.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

PHILADELPHIA ELECTRIC.

The report of the Philadelphia Company for the month of July and four months ended July 31, 1911, compares as follows:

	1911	1910
July gross	$1,530,108	$1,620,949
Expenses and taxes	994,874	922,430
July net	535,234	698,519
Four months gross	6,625,333	6,740,544
Expenses and taxes	4,025,118	3,700,235
Four months net	2,600,215	3,040,309

CUMBERLAND TELEPHONE & TELEGRAPH.

The report of the Cumberland Telephone & Telegraph Company for the month of July and seven months ended July 31, 1911, compares as follows:

	1911	1910
July gross	$ 611,108	$ 565,555
Expenses	368,366	321,582
July net	242,741	243,973
Charges and tax	50,681	48,802
July surplus	192,060	195,171
Seven months gross	4,206,462	3,931,564
Expenses	2,496,191	2,237,426
Seven months net	1,710,271	1,693,938
Charges and tax	357,718	336,334
Seven months surplus	1,352,553	1,357,604

AMERICAN LIGHT & TRACTION.

The report of the American Light & Traction Company for the month of July and seven months ended July 31, 1911, compares as follows:

	1911	1910
July gross	$ 284,892	$ 250,723
Expenses	9,537	10,669
July net	275,255	240,054
Seven months gross	2,295,203	2,050,755
Expenses	65,583	68,346
Seven months net	2,229,620	1,982,409

NASHVILLE RAILWAY & LIGHT.

The report of the Nashville Railway & Light Company for the month of July and seven months ended July 31, 1911, compares as follows:

	1911	1910	1909
July gross	$ 154,671	$ 144,548	$140,886
Expenses and taxes	93,961	84,134	85,547
July net	60,710	60,414	55,339
Charges and depreciation	38,520	37,708	37,220
July surplus	22,190	22,706	18,118
Seven months gross	1,106,789	1,032,501	972,590
Expenses and taxes	658,006	600,722	579,163
Seven months net	448,783	431,779	393,428
Charges and depreciation	268,211	266,403	258,330
Seven months surplus	180,572	165,376	135,096

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of July compares as follows:

	1911	1910
July gross	$ 710,067	$ 682,611
Expenses	337,555	318,594
July net	372,512	364,018
Charges, taxes and preferred dividends	140,079	140,113
July surplus	232,433	223,905
Seven months' gross	4,492,019	4,264,859
Expenses	2,266,349	2,066,722
Seven months' net	2,225,670	2,198,137
Charges, taxes, preferred dividends	980,554	981,254
Seven months' surplus	1,245,116	1,216,883

NORFOLK & PORTSMOUTH TRACTION.

The preliminary statement of earnings of the Norfolk & Portsmouth Traction Company for the year ended June 30, 1911, compares as follows:

	1911	1910
Gross earnings	$2,091,616	$1,920,841
Operating expenses	1,212,404	1,110,489
Net earnings	879,212	810,351
Taxes, interest, etc.	743,579	777,216
Surplus	135,632	33,135

Mexico Tramways Company.

The Mexico Tramways Company, which owns and operates the street railway system of Mexico City, has just issued its annual report for the year ended June 30 last. The report shows that the company earned a surplus available for dividends equal to 8.59 per cent on the $16,487,400 capital stock outstanding, as compared with 5.59 per cent in the year previous on the same amount of stock, or 8.03 per cent on the $11,487,400 stock then outstanding.

The company made a gain in gross earnings for the twelve months exceeding $600,000, nearly $500,000 of which was saved for the improvement in net. About $362,000 more was paid out in dividends to stockholders, so that the surplus for the year after all deductions was $477,722, or about $133,000 more than in the year previous. The profit and loss surplus on December 31 last stood at $894,066, an increase over the previous year of $177,722. The ratio of operating expenses to gross revenues for the year was 49.06 per cent, as against 50.02 per cent in the year previous.

For the purpose of providing funds for general purposes of the company, including the carrying out of extensions and making advances to the Mexican Light & Power Company in connection with the construction of its additional hydroelectric installations, the company during the year issued and sold 50,000 shares of capital stock. The physical condition of the company's property, rolling stock and plant through the year has been well maintained, there having been expended $700,000 for maintenance.

During the past six fiscal periods the company's earnings have shown annual increases, the highest total having been made in 1910, both as regards gross and net income. During the last fiscal period the company carried more than 76,000,000 passengers, as against not quite 72,000,000 in the year previous. The gross income and net income have almost doubled during the last six years, being $5,882,534 and $2,996,610, respectively, in 1910, as against $3,642,106 and $1,465,732, respectively, in 1905. D.

AMONG THE CONTRACTORS AND SUPPLY MEN

DEY & SMITH, electrical contractors of Red Bank, N. J., have dissolved partnership. The business will be conducted hereafter by Snowden Dey and George Van Guillmore.

WARDEN & FARRELL, Random Lake, Wis., have been awarded the contract for the installation of an electric light plant, including two thirty-five-kilowatt generators.

PHILIP H. LOUGHLIN, Gardiner, Mass., has been awarded the contract for installing the electric lighting system in the Town Hall at Gardiner. Tungsten lamps are to be used.

THE NEW YORK ELECTRIC COMPANY, Colorado Springs, Colo., received the contract for wiring the new Burns Theater in that city. Some 3,500 incandescent lamps are to be used in the interior of the building.

ALBERT BARNES, Freeport, Ill., was awarded the contract for entirely rewiring the Grand Opera House at Freeport. New switchboards will be installed, also new border lights and footlights. The wiring is all to be in conduit.

THE TURNER ELECTRIC COMPANY, of Elmira, N. J., will do general electrical contracting work. The incorporators of this company, which was recently organized with a capital of $10,000, are: Thomas F. Fennel, Clay W. Holmes, S. H. Turner and E. J. Pettengill, all of Elmira.

THE HOWARD ELECTRIC COMPANY, Topeka, Kans., has the contract to construct an electric light line from Topeka to the industrial Institute, two miles east of the city. The company will also wire the grounds for street lights and will wire the seven buildings of the institution.

JOHN J. KEARNEY, of Albany, N. Y., has been awarded the following contracts: By the Manhattan Steamboat line, for the lighting of Columbia Street bridge; by S. Laventhall, for the electrical wiring of the four new flats at the corner of Hudson Avenue and South Pearl Street; by John Riley, for the wiring of a new two-flat house on Orange Street, and the wiring of a new villa at 832 Chestnut Street, all in Albany.

New Electrical and Mechanical Apparatus and Appliances

Pittsburgh Series Street-Lighting System.

A system of series lighting has been designed by the Pittsburgh Transformer Company, Pittsburgh, Pa., for use with Mazda lamps. The system consists of a step-down transformer for use on a current of 1,100 or 2,200 volts; lamp fixtures and reflectors; and a lamp-fixture support or mast arm which also carries a regulating coil.

This transformer is designed for mounting outdoors upon a pole so that it can be placed at a central point for distributing current to the system. It is thus unnecessary to run special mains from the power plant. The transformers are of the oil-cooled type and are built to be weather-proof. The primary windings are regularly supplied with standard voltages above mentioned, but there are additional taps at five and ten per cent below the normal to compensate for line drop and thus permit a better adjustment of the secondary voltage. On the secondary side there are six voltages available so that although a system is started with a given number of lamps this number may be added to from time to time with no other change necessary except changing the connection at the transformer to the proper tap. Thus, if a transformer was ordered to take care of fifty lamps the additional taps would take care of forty, forty-five, fifty-five or sixty lamps. These taps are brought to a terminal block inside the case, thus keeping all connections under oil. The transformers also serve to insulate the supply line from the series system.

The lamp fixtures and reflectors available are of several types. All reflectors are of glass-enameled steel and are fluted or curved so that the center of the light source is brought near to the reflector. The canopy, which contains the regulating coil, supports the hood and has cross arms for overhead construction. A high-tension insulator is provided between the canopy and this support. The fixture known as No. 358 has a reflector eighteen inches in diameter made of one piece of steel. It is white underneath and blue on top. This reflector is recommended especially for its simplicity, ease of cleaning, and durability in all conditions of weather. Its surface is smooth and it is not likely to collect dirt. Fixture No. 361 is of similar material, but is fluted and flat and designed to diffuse the light over a maximum area. Fixture No. 364 is also of the same material, but is flat underneath so that the center of the light source may be brought near the reflector. It is also eighteen inches in diameter.

A variety of supports for the lamp fixture are available in this system. The scroll hanger or arm, shown in Fig. 1, is constructed of channel-iron and is braced so that it is much stronger than an ordinary goose-neck pipe. It may be obtained in either the galvanized finish or painted black.

The mast arm shown in Fig. 3 is also formed of channel iron and is bolted and braced so that it will support a weight at the end of the arm of over 400 pounds. It is comparatively light in weight and ornamental in appearance. Four arms for insulators hold the wires rigid, thus preventing them from swaying and possibly short-circuiting the line. This arm is hinged near the pole, permitting the fixture and lamp to be dropped for inspection, cleaning or renewal, as shown in Fig. 4. These mast arms may be had in two styles, one painted black, the other with the galvanized finish.

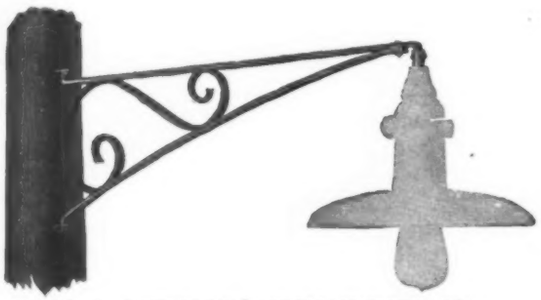


FIG. 1.—PITTSBURGH SCROLL HANGER ARM.

FIG. 2.—PLAIN HANGER ARM.

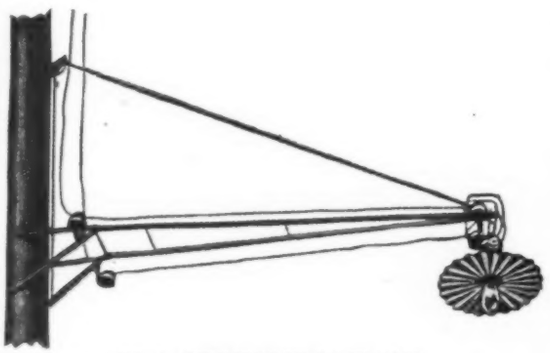


FIG. 3.—PITTSBURGH MAST ARM.

This system is designed for use with Mazda lamps and the current capacity of all lamps in one series must be the same. It is preferable to have the voltage of all the lamps the same, so that the fixtures and regulating coils can be interchangeable, but it is not essential. If a larger or smaller lamp than usual is desired at any particular point it must be chosen to have the same current capacity as the other lamps, but a different voltage. Its regulating coil must then be designed for

its voltage. The sum of the voltages of all of the lamps must equal the voltage for which the circuit is arranged. Any form of switch may be used for controlling the series of lamps. The adjustment of the reflectors has been so calculated that the maximum candlepower is in a direction of fifteen degrees below the horizontal, thus giving a wide distribution of light.

The regulating coil is mounted in the dome of each lamp fixture and operates to maintain the continuity of the circuit when a lamp burns out. It has no moving parts or contacts and requires no attention or adjustment. The coil is so designed that it has an impedance approximately equivalent to that of the lamp. These coils are treated by the vacuum process and impregnated with a weather-proof compound so that it is unaffected by any weather conditions.

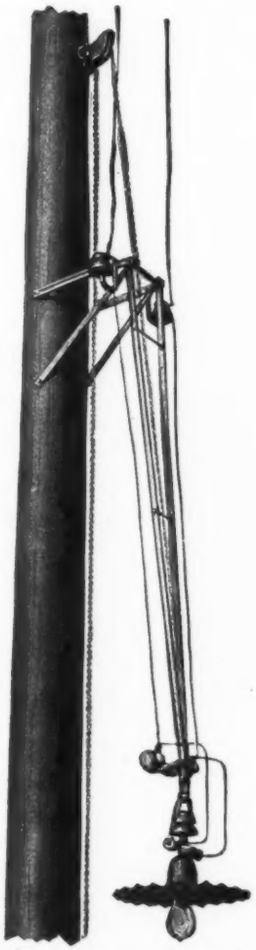


FIG. 4.—MAST ARM LOWERED.

The use of silicon-steel in the cores of the regulating coils and of the transformers renders the efficiency of the system very high, ninety-six per cent being exceeded. The power-factor of the circuit is also above ninety-six per cent. The use of Mazda lamps affords a high-efficiency unit of low candlepower, and by frequent spacing and low mounting it provides a more even distribution of light than is possible with large units at greater intervals.

The New Packard Bell Ringer.

Users of bell-ringing transformers should read over rule 30-C of the revised Electrical Code which requires that air-cooled transformers used inside of buildings shall be mounted one foot from combustible material or on a slab of non-combustible non-absorptive insulating material.

To meet the above requirement, the Packard Electric Company, Warren, O., has brought out a new bell ringer mounted on a neat enameled-slate slab all ready to install.

The core loss of this instrument is about one-half watt and it will stand a continuous short-circuit without damage to either the transformer or the bell wiring. Secondary voltages of six and eight-volts are furnished. Primary leads are of heavily insulated cable and the core and coils are vacuum-treated with a water-proof insulating compound. The case is of cast iron neatly finished in black baked enamel.

PACKARD BELL RINGER.

Asbestos.

The mines of Canada today produce the major portion of the asbestos used in the industrial world. For six decades or more it was known that Canada possessed this mineral, but the fact was not considered of commercial importance. In 1877 a farmer discovered deposits of considerable area and the first real mine began operations shortly afterward. It is said that the enterprise was a paying one from the start. Asbestos was first mined in Italy, and prior to 1880 it was the only country that produced it at a commercial profit. The Italian asbestos is brown in color.

New Ornamental Street-Lighting Standards.

The value of ornamental street lighting is now well recognized—both from the standpoint of the city and from the standpoint of the central-station company. Such an installation, however, can only realize its full value by being attractive by day and efficient by night. The selection of equipment, then, is of the utmost importance as quite frequent installations have lost their effectiveness on account of improper posts, lamps, etc.

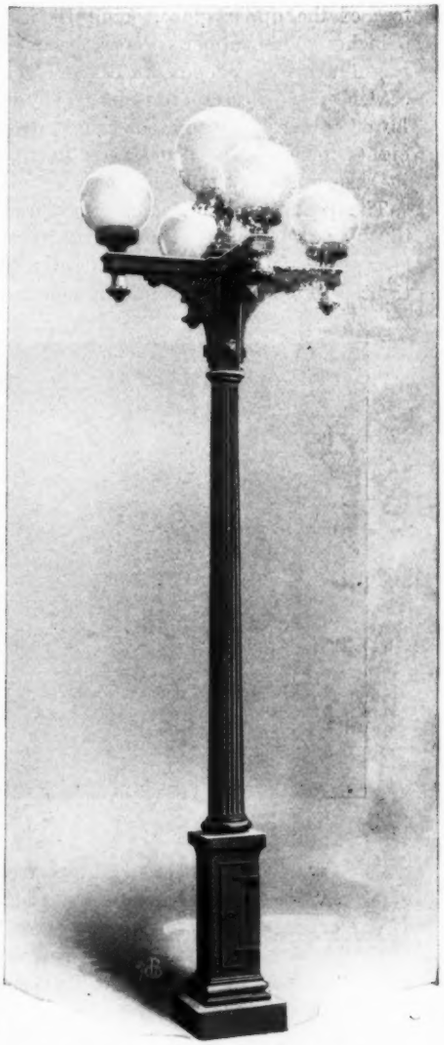


FIG. 1.—ORNAMENTAL POST.

In Fig. 1 is shown a new ornamental standard being offered by the St. Paul Foundry Company, St. Paul, Minn., specially adapted for the smaller progressive cities who wish modern street lighting at a low cost. These standards are of simple design, made for either three or five lights with adaptable sockets permitting either pendent or up-

turned lamps. The equipment commonly used consists of one 100-watt tungsten-filament lamp in a twenty-inch opaline globe at the top. The pendent globes, twelve inches in diameter, contain sixty-watt lamps. The upper light is on a separate circuit and is usually burned all night, the lower lights being turned off at midnight. A door is provided in the base to allow access to switches and wiring.

This standard is known as No. 50 and is twelve feet from the base to the bottom of the upper globe, being 10 feet 6 inches to the upper side of the horizontal arms. The distance from the center of the post to the center of the lower globes is eighteen and five-eighths inches. The pedestal is twenty inches square at the base.

The posts are made of cast iron throughout, all joints and connections being machined to insure absolutely tight joints. The general dimensions may be varied if desired; also street signs may be attached at a slight additional expense.

Standard No. 50 conforms in general design to the company's more expensive standard known as No. 51 an installation of the latter being shown in Fig. 2, which is a night view of Sixth Street, St. Paul, Minn.

FIG. 2.—NIGHT VIEW OF SIXTH STREET, SAINT PAUL.

Electric-Sign-Projector Guarantees.

Experience with devices consuming electrical current has taught the merchant that there is only one satisfactory way to buy such a device, and that is, with a guarantee from the manufacturer as to current consumption and renewal cost.

The Electric Sign Projector, which is now coming into extensive use, is sold with a positive guarantee as to cost of current consumption and renewals.

This device is now made in three different models. Model A is equipped with a specially designed 132-watt Westinghouse-Nernst glower, guaranteed by the manufacturers to have an average burning life of 200 hours at rated voltage. The cost for current at 110 volts at ten cents per kilowatt-hour is guaranteed at 1.3 cents per hour. If burned 5 hours per day, 30 days per month, the cost per month for current will, therefore, be $1.95. The cost of renewals per month, under the guarantee, would amount to fifty cents. This makes a total monthly operating cost of $2.45.

Model B is provided with a 260-watt Edison stereopticon lamp which has a rated useful life of fifty hours at rated voltage. This makes the cost of current at rated voltage at the ten-cent rate 2.6 cents per hour. If burned 5 hours per day, 30 days per month, the cost per month for current will, therefore, be $3.90. This model requires three renewals per month at a cost of $2.25; therefore, the total monthly cost is $6.15.

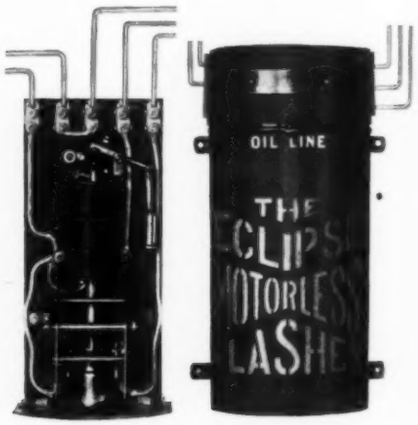
Model C is the same as Model A, except that it is equipped with a specially designed 66-watt Westinghouse-Nernst glower, with a guaranteed average burning life of 200 hours, the same as the 132-watt lamp used in Model A. This burner cuts the guaranteed cost of current used by Model A exactly in two, but the renewals cost thirty-five cents per month; making a total monthly operating cost of $1.33.

With these guaranteed figures before him, the merchant is enabled to figure out in advance exactly what this very profitable form of display advertising is going to cost.

Motorless Sign Flasher.

The Eclipse Electrical Manufacturing Company, 418 Milwaukee Avenue, Chicago, Ill., has adopted the principle and construction used in its flat-rate controller in the design of a motorless sign flasher. The flat-rate controller consists essentially of a solenoid and plunger which breaks a contact in the circuit when the current exceeds a given value. As soon as the circuit is broken the solenoid is de-energized and the circuit is again closed. The controller thus continually makes and breaks the circuit until the load is reduced to the normal value, the frequency of the breaks being kept low by the use of a dashpot.

In the sign flasher this apparatus operates similarly to open and close the circuit supplying the sign, and when desired the connections can be arranged so as to flash the current first in one side and then in another. Since both circuits are never closed at the same time the current consumption is no greater than for a single sign. Flashers of this type can be supplied for either direct or alternating current.



MOTORLESS SIGN FLASHER.

The mechanism is immersed in oil which provides good insulation and prevents sparking at the switch contact. The mechanism is of polished brass mounted upon an ebony-asbestos board. Enamel-insulated wire is used in the solenoid. The contact switch is closed by gravity, and the frequency of operation can be adjusted by means of a set-screw, being independent of the number of lamps connected.

Lighting Standards.

A form of ornamental lighting that is becoming very popular is boulevard lighting. In many cities the municipalities, following the footsteps of progressive merchants have installed ornamental lighting systems throughout the entire boulevard and park system.

A type of standard that is meeting with marked success for lighting of this character is shown in the accompanying illustration. It is graceful in design, rigid in construction and its simplicity makes it impressive.

This standard is particularly suited for park lighting. It stands eleven feet high and can be set among foliage and trees without having the source of light hidden as is the case with standards of two or more lights having protruding arms.

Two of the illustrations show special

FIG. 1.

standards made for building lighting. Fig. 1 is a type of standard installed on the Clearfield National Bank Building, Clearfield, Pa., and Fig. 3 is a bronze standard installed at the United States Mint, Philadelphia, Pa.

Standards of these types are made according to individual specifications so as to harmonize with the decorations of their surroundings. They add greatly to the ornamentation of a building, either inside or outside and are becoming very popular. An idea of their artistic design may be gained from the illustrations.

The standards described and illustrated are manufactured by the Flour City Ornamental Iron Works, Minneapolis, Minn.

The Schweitzer Synchronism Recorder.

In a paper entitled "Synchronism and Frequency Indication," read at the eighteenth annual convention of the American Institute of Electrical Engineers, Paul M. Lincoln states three functions the ideal synchronizing device should perform, which are:

(1) It should tell the amount of difference in frequency.

(2) It should tell whether the machine being synchronized is running too fast or too slow.

(3) It should indicate exact synchronism.

FIG. 2.—FOR BOULEVARD LIGHTING.

A device which would fulfill these specifications became necessary by reason of the increasing size of alternating-current generators. Snychronizing lamps or voltmeters although good enough for small machines, are inadequate for the proper paralleling of larger units. With the rapid growth of alternating-current systems, and the demands for still larger generating units, a much higher refinement has been made necessary in the synchronizing operation. In order to obtain this refinement not only is it important that the best instruments be used, but actual records must be had of each operation, both as a check on the operator and as evidence in case of failure of any part of the apparatus. As a further requisite for the ideal synchronism indicator should be added, therefore:

(4) It should automatically record the operation of switch closing when a machine is paralleled, showing the relative phase and whether the incoming machine was running at a higher or lower frequency than the system, when the control switch was closed, and when the oil switch closed.

A device which fulfills all the above specifications has been in use for some time by one of the largest central-station companies in the world, giving entire satisfaction. The illustrations show two of these recording devices attached

FIG. 3.

to synchronism indicators on the generator control board in one of this company's stations. The essential elements of the recorder are:

(1) A paper-holding and shifting device.

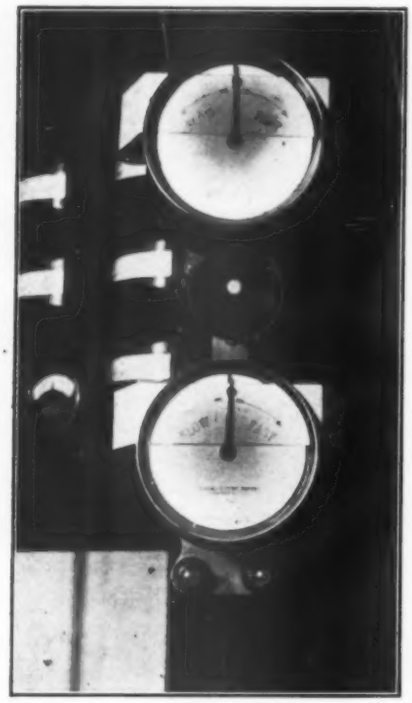
(2) An insulated ring in the indicator dial.

(3) A spark coil with vibrator.

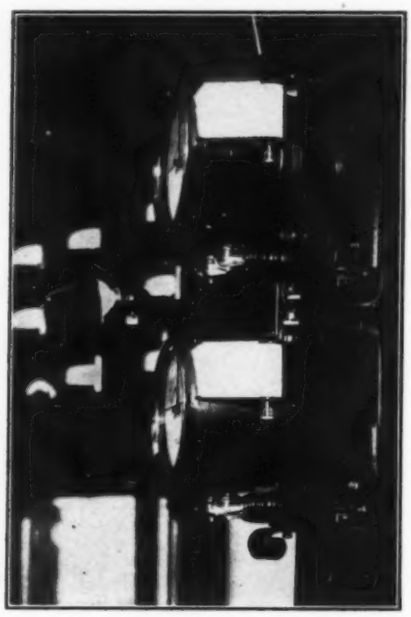
The paper-holding device consists of two metal spools and guides, mounted one on each side of the indicator, a continuous ribbon of paper feeding from the spool on the left across the upper half of the indicator dial to the spool on the right.

The dial plate of the indicator is replaced by one of insulating material having a brass ring set in flush with

its surface, the ring having a radius a little less than the length of the instrument pointer, and furnished with an insulated stud extending through the back of the indicator case. To the under side of the pointer and directly in front of the ring is soldered a platinum point. The leads from the spark-coil secondary are connected, one to the insulated stud, and one to a stud screwed into the instrument case. The primary leads are connected to a direct-current source, as an exciter or operating bus, through an auxiliary contact, the location of which depends upon the scheme of control wiring. The purpose of the auxiliary contact is to close the circuit to the spark coil simultaneously with the closing of the control switch and to keep it closed until opened by the operator.



SCHWEITZER SYNCHRONISM RECORDER.



SIDE VIEW OF RECORDER.

With the energizing of the spark coil at the time the control switch is closed, a succession of sparks jump from the insulated ring to the electrode on the pointer, puncturing the paper ribbon and forming the record. Any number of switches may be connected to the common lead to the spark coil.

With electrically operated oil switches the operator closes the control switch a little before the pointer of the indicator has reached the synchronous position, judging this by the time lag for the particular type of oil-switch mechanism in use and the beat or difference in frequency between incoming machine and system.

For a perfect operation the record will be a very short row of quite large punctures, all on one side of the synchronous position, if the machine was running faster than the system, and all on the other side if slower than the system. If the operation was ill timed the record will extend beyond the synchronous position, if too slow, or if too quick the record will show a succession of almost uniformly spaced punctures between the time the control switch was closed and the oil switch closed and then a much wider spacing as the pointer is jerked quickly to the synchronous position. A difference in beat or the rate of rotation is shown both by the difference in spacing and the size of the puncture.

In short, the slightly varying records of every-day operations as well as the occasional faulty ones are all easily analyzed in a moment's time. In case of accident or damage through failure of a switch to close at the proper time undisputable evidence is at hand which is otherwise very difficult or impossible to obtain.

The value of such a device when connected for service on a large system, although very apparent, is difficult to estimate in dollars and cents. It acts as an insurance in causing greater care on the part of switchboard operators and thus greatly improving the service and furnishes reliable data for the determination of causes leading to system disturbance at the time of paralleling machines. Where installed they have been welcomed both by the management and the switchboard operators.

The device is manufactured by the Chemelectric Company, 4327 Kenmore Avenue, Chicago, Ill.

The Benjamin Reducer.

Users of incandescent lamps will doubtless be interested in the Benjamin reducer just placed on the market by the Benjamin Electric Manufacturing Company, Chicago, Ill.

The Benjamin reducer, which is shown in the accompanying cut, can be used for adapting large-base (Edison No. 41) sockets, for the use of standard small-base (Edison No. 1) lamps. In attaching, the center of contact is lowered about one-half inch.

As many lamp users have hesitated about installing fixtures, owing to the constantly changing conditions in the incandescent-lamp field, this device will, no doubt, meet a need which has been widely felt.

BENJAMIN REDUCER.

Insulation of Leatheroid and Pressboard.

Some tests on the insulating properties of leatheroid and pressboard are reported by D. H. Ogley in the *Electrical Review*, London. Tests were made in normal condition, vacuum-dried, exposed to damp atmosphere, impregnated with shellac compound, and after heating in an oven at 100 degrees centigrade for a week.

The pressboard varied very little under the different conditions, heating or moisture making but a slight change in the breakdown voltage.

Leatheroid, however, deteriorates rapidly if damp, and even under normal conditions shows a strength less than half as great as when vacuum-dried. The strength of both materials was greatly increased by impregnation.

Large carpets which can be heated by electricity have been put upon the German market by Baur & Company, of Zurich, Switzerland.

Convention of Bissell Salesmen.

A three days' conference of the salesmen of the F. Bissell Company at Toledo, O., was held August 31 to September 2. The work of the company was thoroughly explained to the salesmen and a number of papers read. The following addresses and papers were presented by members of the staff.

"White Reports" and "Follow Up Work"—"Their Value to the Salesman," by M. E. Townsend.

"The Repair Department and What it Means to You," by Mr. Cox.

"The Cross-Arm Situation as It is and as I Found It," by Mr. McNary.

"Security Iron Box—Box Sales and Suggestions Gleaned on Recent Western Trip," by Mr. Hamilton.

"Report on Pole Situation and What the Forest-Product Department Expects," by Mr. Navarre.

"The Bissell Motor for Sewing Machines," by Mr. Bissell.

CONVENTION OF BISSELL SALESMEN.

"How to Know a Cross Arm and the Pin that Goes With It—Quality Talking Points," by Mr. Navarre.

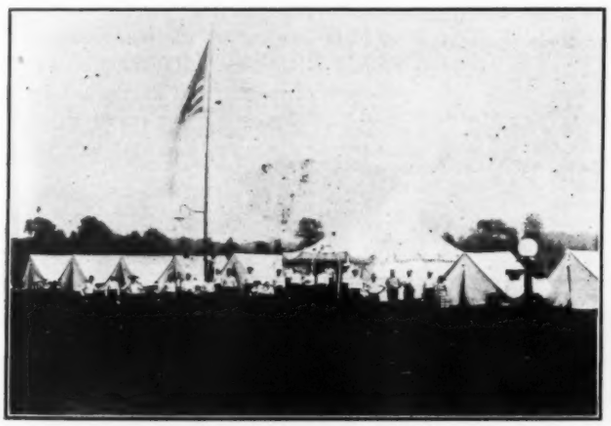
"Competitive Illuminants," by Mr. Harrison.

"Sales Methods that Have Secured and Developed Lamp Business," by Mr. Vaughn.

"Industrial Illumination," by Mr. Monroe.

"Collections," by Mr. Lloyd.

A visit to the shops and inspection of stocks was also made.



CAMP AT RIVERSIDE FARM.

GROUP AT STERLING CONFERENCE.

Sales Conference of the Sterling Electrical Manufacturing Company.

During the week of August 14 the sales and engineering departments of the Sterling Electrical Manufacturing Company, of Warren, O., held a six-day conference at Riverside Farm, three miles up the Mahoning River from Warren, as the guests of William E. Coale, treasurer and manager of the company.

Camp Riverside proved a delightful place for the conference, and a most satisfactory convention was enjoyed by everyone present. A complete Mazda street-lighting system was installed, with lights in every tent.

One of the features of the conference was the presentation of a paper by Mr. Coale entitled "Warren Beautiful." This describes in detail the civic movement which culminated recently in the installation of a complete Mazda street-lighting system in Warren, O., the first city in the United States to exclude every other form of lighting. This study has been prepared for publication in a unique booklet which will be distributed to central-station managers, municipalities and officers of business men's organizations interested in street lighting movements.

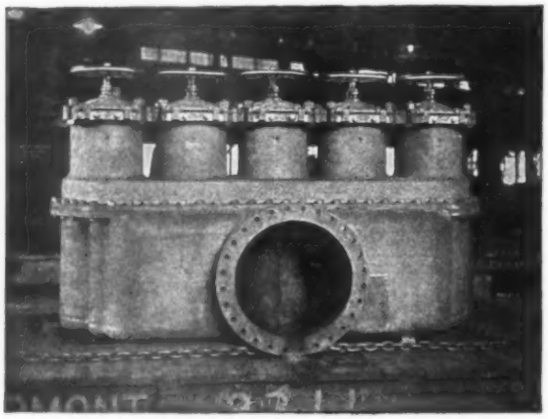
The Largest Water Strainer Ever Built.

The illustration on next page shows one of the two strainers recently built by the Lagonda Manufacturing Company, Springfield, O. One of these strainers was furnished to the Toledo Railroad and Light Company and the other one to the Metropolitan Street Railway Company, Kansas City, Mo. These strainers are claimed to be the largest ever built for removing foreign matter from water. The total weight of each is 11,000 pounds. They measure 10 feet 1.5 inch from end to end and the height above the bottom flange to the top of the hand wheel is 6 feet 1 inch.

While these figures are impressive, the point which will undoubtedly be

most interesting to the operating engineer is the fact that while each of these strainers is built with five independent straining baskets, three baskets when in operation provide a free area greater than that of the thirty-inch pipe in which the strainers are connected, and when all of the baskets are in service the total straining area is several times that of the supply pipe.

While these strainers are of such massive dimensions, very little difficulty is encountered in removing the baskets for cleaning purposes. To clean them it is only necessary to turn the hand-wheel, which raises the baskets entirely out of the strainer, at the same time shutting off the water from that straining compartment. The basket can then be lifted out and all foreign matter removed and the basket quickly returned again.



LAGONDA WATER STRAINER.

In service it is recommended that at least one straining basket be kept out of service to act as a reserve.

This provides ample insurance against total shut-down of the water and makes it unnecessary to have two large strainers in duplicate.

A New Idea in Fixture Construction.

A system of electric-light fixtures that marks one of the most radical advances in the history of the trade, has been recently perfected by The Tungstolier Company, Conneaut, O. They are known as the T. T. C. Tungstoliers, and embrace an entirely new idea in fixture construction.

It comprises a fixture in which the body, bottom shell, canopy and arms are built up into separate pieces so arranged that taking them apart or putting them together is the work of but a moment. The body and arms are ready wired, a patented spring clip in the arms engaging the contacts in the body which is provided with holes for their insertion.

FIG. 1.—SHOWING PARTS OF FIXTURE.

These arms, bottom shells and canopies are interchangeable, so that it is possible to construct fixtures of many different designs with comparatively few pieces. With a complete equipment of T. T. C. parts, which consists at present of eighty-six pieces, it is possible to construct 1,944 separate and distinct designs, and with an amount of stock that will occupy only a few feet of shelf space. The fixtures reach the dealer in sealed packages, the different parts packed in separate cartons, so that the dealer has simply to put the packages on his shelves until a fixture is needed, when it can be put together in two minutes, thus greatly reducing the deterioration of the stock.

Assembling and putting up a T. T. C. Tungstolier is a very simple matter, the only tools needed being a wrench, a screw-driver and a pair of pliers. There is no wiring, no cutting of pipe, almost no labor.

FIG. 2.—ASSEMBLED FIXTURE.

What this system will mean to the fixture dealer or central station can readily be seen. By an outlay of only $120 he can secure the equivalent of almost two thousand different fixtures for display purposes, and at the same time be able to display the entire line in a show room fifteen feet square. The large display, large investment in stock, heavy deterioration and burdensome overhead expense are done away with. A thoroughly first-class fixture business can be done upon a very small investment and in a very small shop, which makes the business an attractive side line for both contractor and central station.

FIG. 3.—ANOTHER TUNGSTOLIER FIXTURE.

Current Electrical News

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The Public Service Commission, First District, in a recent ruling prescribed a modification of the uniform system of accounting which was ordered December 8, 1908. The modification consisted of the addition of two primary accounts to be entitled "Joint Transmission Expense, Dr." and "Joint Distribution Expense, Dr." The first is defined as the portion of expense to be met by the accounting corporation where any transmission lines, etc., are maintained by another person or company for the joint benefit of the accounting corporation. The second account covers the expense of the distribution structure or facilities maintained in a similar manner.

The Long Acre Electric Light & Power Company has executed a general mortgage to the Empire Trust Company covering all its property in Manhattan and the Bronx for $50,000,000. The company has received authority from the Commission to issue stocks and bonds to the amount of the mortgage. Announcement of the company's financing plans will be made later.

The Commission, Second District, has heard the application of the Mohawk Hydro-Electric Company for approval of the construction of transmission lines in the towns of Ephratah and Palatine and the village of Nelliston, and for the consent and authority for that company to issue $36,000 in six-per-cent thirty-year first-mortgage bonds; also the application of the Mohawk Hydro-Electric Company and the Fort Plain Gas & Electric Light, Heat & Power Company for consent to the leasing of the Fort Plain Company's electrical distribution system in the village of Nelliston to the Mohawk Hydro-Electric Company.

The application of the Richfield Springs Electric Light & Power Company for permission to assign its franchise in Richfield Springs to the Richfield Springs Utility Company and the application of the Richfield Springs Utility Company for the right to acquire this franchise and for permission to issue $47,000 in mortgage bonds were both heard at Albany.

On Friday at Buffalo the Commission heard the complaints of the president and trustees of the village of Silver Creek, Chautauqua County, against the Buffalo & Lake Erie Traction Company as to service afforded in that village, and also the complaint of the United States Light & Heat Company against the Niagara Falls Gas & Electric Light Company for refusal to extend gas mains to the complainant's plant.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

A MUNICIPAL VENTURE.—The city of Big Rapids, Mich., plans to dam the Muskegon River at Ryan's Creek, install a hydroelectric plant, at a cost of about $250,000, and proposes to sell power in competition with big privately owned plants. A survey, which was recently made, brought forth the statement that such a venture would prove highly profitable. According to the report of the city engineer, lighting and power will be furnished so cheaply by this municipal plant that the rates now in effect for electric power in that part of the state will be greatly lowered. The estimated price of the plant, $250,000, carries into consideration not only the plant and dam, but enough advertising to place the plant's product before the people and the manufacturers. The estimate of the cost of the dam is $67,660, the structure to be built of concrete; $7,020 for the earth embankment; $35,100 for the power house; $28,500 for the three water power turbines; $41,440 for electrical equipment at power house; $7,780 for transmission lines and $5,000 for cost of flooded lands.

TEXAS DEVELOPMENT APPROVED.—The contract that was recently entered into by the City Commission of Austin, Texas, with William B. Johnson, of Hartford, Conn., representing the Hydraulic Properties Company, of New York, for the reconstruction of the large dam across the Colorado River and the installation of a hydroelectric plant, which work shall cost $1,720,000, has just been ratified by vote of the people of Austin. Owing to the fact that these public works are to be paid for out of the earnings of the municipal light and power plant, the right to vote on the proposition was not confined to the tax payers. The original dam was washed away eleven years ago by a flood in the river. Several attempts have been made since then to bring about its reconstruction, but none of the plans were successful. Under the terms of the present contract the city is to pay to Mr. Johnson $100,000 for the completion of the dam and hydroelectric plant and the rest of the $1,720,000 is to be paid in semi-annual installments of $32,400 each without interest. The contractor is required to operate the power plant during this term of years and deliver to the city all power generated. He is required to install equipment capable of producing 7,200-horsepower. A minimum of 600,000 horsepower-hours per month is guaranteed. The dam itself will be the largest structure of its kind in the state. Its height will be sixty-five feet, which is five feet higher than the old dam. In case the dam or power plant is washed away the contractor must replace it or lose all unpaid installments. He is also required to keep the works in first class repair during the twenty-five-year period. The City Commission reserves the power of making and regulating the rates for water and electric lights. One of the important features of the project is the large lake that the dam will create. Besides the dam and hydroelectric plant the contractor must construct a water storage reservoir of 10,000,000 gallons capacity for the purpose of keeping on hand a reserve supply for the use of the city. He must also install pumps to keep this reservoir full. The works must all be finished within two years. Preliminary construction work has already been started and it is stated by Mr. Johnson that the entire works will be finished within one year. The dam will be of concrete construction. D.

BIDS ASKED FOR PANAMA PLANT.—Bids are being asked by the Isthmian Canal Commission for furnishing plant and material for a hydroelectric station at Gatun, Canal Zone. The hydroelectric station is to be situated near the spillway in the heart of Gatun dam and is to have a present building capacity of 6,000 kilowatts. An ample supply of fresh water at a practically constant temperature of eighty-five degrees Fahrenheit is obtainable from Lake Gatun throughout the greater portion of the year. The lake surface will be not more than ninety-one feet or less than eighty-seven feet above mean sea level. The building structure of the station is to be of reinforced concrete. The station equipment is to be divided into three complete units of 2,000 kilowatts each. In addition there are to be installed two 100-kilowatt motor-generator exciter sets and the various auxiliaries for regulation and control of the turbo alternators. The turbines are to run satisfactorily in parallel with the steam turbine-driven generators now connected to the present three-phase, 2,200-volt, twenty-five-cycle alternating-current system. The units installed are to be of the vertical type, each unit having a fifty-kilowatt exciter mounted directly upon the shaft. The generating room is to be spanned by the twenty-ton crane.

LIGHTING AND POWER.

(Special Correspondence.)

PRINCETON, MO.—This city has voted electric light bonds to the amount of $7,000.

SOUTH RIVER, N. J.—The old street lamps here have been replaced by tungsten lamps.

KIRKWOOD, MO.—This city has voted bonds for $10,000 to improve the electric light plant.

FARMINGTON, MINN.—F. H. Eddy, of St. Paul, is organizing a company to install an electric light plant. C.

GILBERT, MINN.—The construction of a municipal electric light plant is being considered. C.

POCAHONTAS, IOWA.—Bonds for $11,000 have been issued for a municipal electric light plant.

WARRENSBURG, MO.—An electric light plant is soon to be erected at the State Normal School.

BRYAN, TEX.—The Bryan Power Company has been incorporated with a capital stock of $70,000.

ARLINGTON, S. D.—W. C. Allen and Adam Royin are plaanning to establish an electric light plant here.

HILL CITY, KANS.—The people of this city have voted electric light bonds to the amount of $15,000.

LACLEDE, MO.—The Laclede Electric Light Company has been incorporated with a capital stock of $5,000.

SIDNEY, MONT.—This city has granted an electric light franchise to the Sidney Electric & Fuel Company.

ENTERPRISE, ORE.—The Enterprise Electric Company has been granted a ten-year franchise in this city.

NORTH BRANCH, MINN.—The Eastern Minnesota Power Company will install electric lights here this fall. C.

WILLS POINT, TEX.—J. H. Human and others have organized a company to rebuild the local electric light plant.

BOONE, IOWA.—Work has been commenced on the construction of an electric light plant, estimated to cost $125,000. C.

TOWER, MINN.—Work has been commenced on the construction of the municipal power plant at Pike River Falls.

AMARILLO, TEX.—The Amarillo Water, Light & Power Company is about to increase its capital and build a plant.

HAZLETON, PA.—Engineers representing Edmund Coxe of

Philadelphia, have been making surveys preparatory to establishing a hydroelectric plant on Hazle Creek.

OMAHA, NEB.—The Platte River Hydro Electric Power Company has been chartered by Charles P. Ross and others.

DALLAS, TEX.—The Southern Minneapolis Farm Power Company has been incorporated with a capital stock of $10,000.

HAMILTON, CAL.—The Sacremento Valley Colony Company has requested bids for pumping machinery and electric motors. A.

HARLINGEN, TEX.—This city will vote September 26, on the issuance of $32,000 in municipal bonds, part for electric light plant.

WINONA, MINN.—W. J. Welch, manager of the Winona Railway & Light Company, is planning to thoroughly overhaul the system. C.

CLARION, IOWA.—White & Son, engineers, have completed plans for the erection of a brick building for the electric light plant. C.

CHEHALIS, WASH.—A. W. Van Arsdall has made application for an electric lighting and power franchise throughout Lewis County. A.

LITTLE FALLS, MINN.—The Water Power Company is about to commence the erection of an electric line to the school at Belle Prairie. C.

RUBY, MONT.—The Madison River Power Company is constructing a power line to furnish light to Laurin, Sheridan and Twin Bridges. C.

POCAHONTAS, IOWA.—At a special election a proposition to bond the town for $11,000 to build a municipal lighting plant, carried by a large majority.

FALLS CITY, ORE.—Messrs. Van Zandt & James contemplate the installation of a power plant, for electrical lighting and power, in the Willamette Valley.

ELLIOTT, IOWA.—The Griswold Electric Light & Power Company, Griswold, Iowa, has secured the contract for supplying the town with electric light. C.

LOCKPORT, N. Y.—A certificate of the incorporation of the Lewiston & Lake Shore Power Company has been filed. The amount of capital stock is $25,000.

BRIDGEPORT, CONN.—The Warner Brothers Company, which now owns the largest corset factory in the world, has just completed a $250,000 power plant.

LAS CRUCES, N. M.—The Las Cruces Electric Light & Ice Company has issued bonds for $75,000 for improvements and additions in its electric power plant. A.

LECOMPTON, KANS.—At a special election it was decided to vote bonds to the amount of $2,500 for an electric light plant. The plant will be for lighting the streets.

WILMINGTON, DEL.—Additions are to be made to the power plant of the Wilmington & Philadelphia Traction Company here. The new work will cost about $60,000.

CENTERVILLE, WASH.—The Pacific Power & Light Company, of which J. C. Naylor is local manager, plans for the installation of a lighting and power system at this place. A.

PASADENA, CAL.—The City Council will soon call for bids for the installation of an ornamental street-lighting system on South Orange Avenue. The estimated cost is $50,000. A.

KENDALLVILLE, IND.—The work of overhauling the city electric light and waterworks is estimated to cost about $60,000, and to secure this amount the city may have to be bonded.

SUMTER, S. C.—The Sumter Lighting Company has had orders for a number of motor installations since the company changed hands. Two of the motors have been placed in ginneries.

LOS ANGELES, CAL.—The F. O. Engstrom Company has been awarded a $16,000 contract by the Southern California Edison Company for the erection of a reinforced-concrete substation at Colton, Cal.

NEW HAVEN, CONN.—New electric lights are to be installed by the United Illuminating Company of this city. It is expected that eighty new poles, carrying 400 lights in groups of five, will be erected.

BAKERSFIELD, CAL.—The Bakersfield Gas & Electric Company has been incorporated by H. A. Jastro, H. A. Blodget, L. C. McAfee, L. P. St. Clair and C. E. Jewett, with a capital stock of $100,000.

FRESNO, CAL.—The first car loads of material for the Los Banos power line being built by the San Joaquin Light & Power Company are being placed where needed and work on this line will begin at once.

MELLEN, WIS.—A. E. Appleyard, of Ashland, Wis., has commenced the construction of a power plant to supply electricity to the street railway plants at White River, Ironwood, Ashland, Bessemer and Hurley.

DES MOINES, IOWA.—A company is to be organized with a capital of $10,000, to construct dams, locks and power, plants along the river below this city. A. C. Miller is at the head of the Iowa end of the company. C.

PORTLAND, ME.—The New England Power Company of Maine has been incorporated with a capital stock of $5,000,000. The officers are: President, Clarence E. Eaton; treasurer, T. L. Croteau; clerk, James E. Manter.

CORYDON, IOWA.—The Iowa Engineering Company, engineers, Clinton, Iowa, will prepare plans for the reconstruction of the electric light system, including new engines, generators, boilers, etc. J. J. C. Bower is town clerk. C.

SALT LAKE CITY, UTAH.—The Davis & Weber Counties Canal Company is asking for bids for the erection of a hydroelectric power plant near Riverdale, Utah. The plant, it is said, will have a capacity of 5,000 horsepower. A.

PEORIA, ILL.—D. M. Mayer and others have petitioned the City Council for ornamental lights on North Adams Street between Hamilto and Fayette streets, offering to furnish the equipment if the city will pay for the current. Z.

RIVERSIDE, CAL.—Manifold & Poole, of Los Angeles, are the engineers for the new power system to be established in San Bernardino, Riverside, and other southern California towns by the Southern Sierra Power Company.

LOS ANGELES, CAL.—A committee composed of one resident of each street in Palms, Cal., with S. A. Sterns as chairman, has agreed to install electric street lights in the streets of Palms. Work will begin the middle of October.

LOGANSPORT, IND.—A. J. Yawger & Company has secured the contract to build a power dam in Eel River at West Tenth Street. The new dam will be of concrete and will replace the present wood structure owned by the city. S.

OCEANSIDE, CAL.—The Pacific Light & Power Company has commenced preliminary work on its proposed dam across the San Luis Rey River. A hydroelectric power plant will later be installed for electrical and irrigation operations. A.

PEORIA, ILL.—Bids have been asked by the Peoria Gas & Electric Company for the construction of a steel and concrete tower in the Illinois River which will carry eleven high-tension wires for the transmission line to East Peoria and Washington. Z.

TOWER, MINN.—The cost of the dam and power house in connection with the power plant for which contracts were let recently is estimated at $11,736; the transmission line $4,224; turbine and head gate $2,474, and dynamos and machinery, $2,690. C.

DURANGO, COLO.—In accordance with a contract recently executed between the city and the Durango Gas & Electric Company, the company will supply ninety arc lamps for street lighting. Current will be supplied at the rate of $5.00 per lamp per month.

SAN FRANCISCO, CAL.—The West Sacremento Electric Company has been incorporated by B. P. Lilienthal, William Herlitz and H. W. Furlong, et al., with a capital stock of $100,000. The company plans to operate electrical properties in Sacramento, Yolo and Solano Counties. A.

SAN BERNARDINO, CAL.—The Southern Sierra Power Company has awarded a contract to the C. C. Moore Company for the construction of its new steam generating plant here. The work is estimated to cost $200,000. The company has been granted a fifty year franchise in this city. A.

SANTA ANA, CAL.—The Southern California Edison Company has offered to dispose of its local distributing system to the city, exclusive of other properties, for $165,000, provided that the city will enter into a fifteen-year contract with the company for power at two cents per kilowatt-hour. A.

MEDFORD, ORE.—The Rogue River Electric Company recently sold its light and power plants to the Siskiyou Electric Power & Light Company for $3,300,000. This gives the latter company practically a monopoly of the waterpower resources in northern California and southern Oregon.

SINTON, TEX.—The Sinton Ice & Power Company, owned by S. G. Herlacher, was sold to R. V. Covey of Houston and J. K. Ross of Oklahoma. The name of the new firm will be the Sinton Ice, Light & Power Company. It is proposed to put in a dynamo, sufficient to furnish lights for the entire town.

SPOKANE, WASH.—The engineering work is now in progress for electrical power developments on the Kootenai River at Kootenai Falls, Mont. The plant is to be located seven miles east of Troy and eleven miles west of Libby, Mont., and will supply electrical power to the northwestern portion of the state.

LOS MOLINOS, CAL.—A representative of the Sacremento Valley Power Company is making a canvass of the farming district around this city for the purpose of making contracts for light and power. It is understood that the Northern Electric Company will soon have a man in the field for the same purpose.

ROBINSON, ILL.—The Varney Electric Company is reported to have filed a lien against the Robinson, Water Light & Heat Company in the Federal Court at Danville asking for a sale of the plant to pay debts. The claim is for materials furnished to W. H. Clinton, receiver. Hearing will be had the first Monday in October. Z.

MT CARMEL, ILL.—The property of the Mt. Carmel Gas & Electric Company was sold by order of the Federal Court to Frederick Hartenstein of Cincinnati for $150,000. There will be no change in the local management. J. M. Mitchell will continue as

receiver until the fifteen months allowed the bondholders for redemption have expired. Z.

ESCALON, CAL.—The Escalon Water & Light Company, recently incorporated, contemplates the installation of an electric-lighting system here. S. T. Irwin is interested. A.

RUSHVILLE, IND.—The Rushville Furniture Company is preparing to install machinery in its new factory in the course of erection. The company having failed to secure current from the city is beginning to build a plant to generate electricity for power and lights. The company will be ready to buy electrical machinery and equipment in about a month. S.

COLFAX, IOWA.—The Colfax Electric Light Company has been granted a franchise to maintain a cable for the purpose of transmitting an electric current to Prairie City from the Colfax plant, and will furnish illumination for that city and lighting connection will soon be completed. The Colfax plant has recently been strongly equipped and is giving excellent service.

ALGONA, IOWA.—S. W. Crowell, city clerk, will receive bids until September 21 for one 100-horsepower and one seventy-five-horsepower gas-producer outfit; one seventy-five-kilovolt-ampere alternating-current and one fifty-kilovolt-ampere alternating-current generator, and one switchboard panel. The Ames Engineering Company, of Ames, Iowa, are retained as engineers. C.

LONGMONT, COLO.—The preliminary work on the Longmont municipal lighting plant is progressing rapidly. An option has been secured on a site on the North Fork, above Lyons. Bids for the sale of the bonds have been received. Bids for the construction of the power house and for the transmission lines are also being called for. The plant will be a hydroelectric installation.

COLUMBIA, S. C.—The Courtenay Manufacturing Company, Newry, will install a complete equipment of machinery for furnishing electric lights in its village, office building, store, superintendent's dwelling, etc., and has awarded contract for the same. The Courtenay plant is a $300,000 enterprise, operating 25,536 ring spindles and 640 looms on the production of print cloth.

HILLSBORO, ILL.—The Hillsboro Electric Light Company has purchased the plant of the Greenville Electric, Gas & Power Company for $60,000, it is reported. J. J. Frey of Hillsboro, president of the company is quoted as saying this is part of a plan to build an interurban line connecting Greenville, Hillsboro and Collinsville. Mr. Frey and his company now own thirteen electric light plants and are said to be negotiating for property at Troy, Ill. Z.

BALLSTON SPA, N. Y.—The franchise and properties of the Hudson River Electric Power Company, including the subsidiary companies and the great plant at Spier Falls, were sold recently in mortgage foreclosure proceedings by Senator Harvey D. Hinman, as special master, to Francis M. Edwards of Boston, representing the bondholders' committee, for $7,500,000. The only other bidder for the property was a representative of Anthony N. Brady, the traction magnate.

MARQUETTE, MICH.—Contracts have been awarded for a new water turbine and electric generator to be installed at the city power plant on Dead River. The water wheel and governor will be furnished by James Leffel & Company of Springfield, O., for $5,350; the generator including switchboard complete, two fifteen-kilowatt transformers, lightning arresters, etc., by the General Electric Company of Schenectady, N. Y., for $7,806, making the total cost of the new machinery $13,156.

CLARINDA, IOWA.—The Lee Electric Light Company has completed a seven-mile transmission line to the town of New Market, Iowa, and the street lights were turned on for the first time August 29. The company has also closed a contract with the Bedford, Iowa, Light, Heat & Power Company for the construction of its New Market transmission line on to Bedford, an extension of fifteen miles. The Lee Electric Company expects to place the contract at once for the necessary poles, wire and other material and it is intended to have the line built by December 1.

ST. JOHNSBURY, VT.—The Frontier Electric Company has been organized with Col. C. S. Emery of Newport, president. The capital is $30,000, and it will construct a generating plant for the distribution of light, heat and power, at a point on Jay branch about two miles from North Troy. The dam will be constructed of solid re-inforced concrete. Water will be conveyed in 2,800 feet of four-foot steel penstock to the power house. One hundred and sixty-eight feet fall of water will be obtained and the power to be developed will be 800 horsepower for ten hours per day and 200 for the remainder of the day.

COLUMBUS, O.—The State Tax Commission recently gave out figures showing the total tax valuation placed upon electric and power plants to be $27,745,130, an increase over the figures of last year of $21,256,433. The Marblehead Power Company, Cleveland, was increased from $3,190 to $15,000; The Canton Electric Company, from $153,950 to $1,356,320; the Columbus Railway & Light Company, from $526,000 to $1,534,000; the Cleveland Electric Illuminating Company, from $3,790,895 to $11,375,000; the Dayton Citizens Electric Company, from $99,400 to $500,000; the Springfield Light, Heat & Power Company, from $207,000 to $725,000; and the Bedford Electric Light & Power Company, from $7,230 to $30,000. The total valuation of all lighting and power plants in the state aggregated but $6,488,607 in 1910.

ELECTRIC RAILWAYS.

(Special Correspondence.)

DES MOINES, IOWA.—The Commercial club is agitating the extension of the street car system to South Des Moines. C.

HALSTEAD, KANS.—The Arkansas Valley Interurban Railway Company has been granted a franchise in this city.

BURBANK, CAL.—The Pacific Electric Railway Company has completed its extension from Glendale to this place, and commenced regular service, September 6. A.

RIVERSIDE, CAL.—The City Council has advertised for bids for the purchase of a forty-five-year franchise for a double track electric railroad on certain streets of this city.

VALLEJO, CAL.—The San Francisco, Vallejo & Napa Valley Electric Railway will issue bonds for $1,500,000 for the construction of its proposed line from St. Helena to Calistoga, Cal. A.

SAN FRANCISCO, CAL.—Work has begun on the Sacramento & Woodland electric railroad, a part of the Northern Electric Company's system. The line will be in operation by May, 1912.

MINNEAPOLIS, MINN.—The Dan Patch line has let the contract for grading between Dundas and Comus, Minn., to Christian & Bennett, and between Dundas and Northfield to Mr. Dougherty, of Minneapolis. C.

IOWA CITY, IOWA.—The contract for the construction of seventy miles of interurban line has been let by the Iowa City & Davenport Interurban Railway Company, to C. E. Coon, Omaha, Neb., for $2,000,000. C.

PORTLAND, ORE.—The Mount Hood Railway & Power Company announces that expenditures to total $1,500,000 will be made for extensions and improvements to its power plants and systems, during this year. A.

ST. PAUL.—The Twentieth Century Transportation Company, capital $1,000,000, has been incorporated at Pierre, S. D., to construct an interstate trolley route from Chicago, Ill., to Rapid City, S. D., passing through St. Paul. C.

OREGON, MO.—The City Light & Water Plant of this city is in the market for railway equipment as follows: One second-hand direct-current railway generator 550-600 volts; one fifty-kilowatt street car, combination baggage and passenger type, capable of seating forty to fifty people, control either end, with lights and air-brake equipment; 1,000 rail bonds, new; 250 six-inch by twenty-five-foot chestnut or cedar poles; 250 trolley arms; 4,000 feet three-eighths and one-half-inch galvanized strand; 100 six-inch and eight-inch anchors with rods. Morton R. Martin is superintendent of the plant.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

LANESBORO, MINN.—The Tri-State Telephone Company will erect an exchange here. C.

MITCHELL, S. D.—The Dakota Central Telephone Company is about to erect a new plant.

WABASHA, MINN.—A franchise has been granted to the Greenfield Farmers Telephone Company.

FREMONT, NEB.—The Nebraska Telephone Company has secured a site for the erection of an office building. C.

KELSO, WASH.—The Coweman Telephone Company will soon commence construction on the extension of its system into the Shanghai Valley district. A.

ABERDEEN, WASH.—The Pacific Telephone & Telegraph Company let the contract for the erection of a building on Market Street, estimated to cost $35,000. C.

SLEEPY EYE, MINN.—Business men have let the contract for the erection of a central telephone plant estimated to cost $5,700 with $2,000 additional for wire, cables and other material. C.

OLGA, ILL.—The Olga Independent Telephone Company has been incorporated with capital stock of $2,500. The incorporators are Elwood Barker, S. E. Flannigan, Jr., and Lawrence Smith. Z.

MACOMB, ILL.—The Macomb Telephone Company has been incorporated with a capital of $50,000 to maintain and operate a telephone exchange. The incorporators are Edward S. Slusher, Charles K. Todd, and John C. Lawyer.

COLFAX, IOWA.—The instalment of a new telephone system and completion of the consolidation of the two telephone companies formerly in operation is being made. The Colfax Telephone Company has expended $10,000 in building and plant.

TACOMA, WASH.—The Sunset Telephone & Telegraph Company has let the contract for the erection of a three-story building at North Twenty-seventh and Proctor Streets. The cost of building and site is $26,000 and telephone equipment will amount to $50,000. C.

PORTLAND, IND.—The Home Telephone Company increased its rates and the city refused to pay the increase for phones used in the city offices. The company discontinued the service and the city brought suit to oust the company from the streets on the ground that it has no franchise. A new or renewal of franchise will be granted only with the provision that the rates be made what they were previous to the recent increase. S.

ELECTRICAL SECURITIES.

Stockholders of the American Power & Light Company have subscribed to approximately ninety-five per cent of the $2,200,000 ten-year six-per-cent gold notes offered to them for subscription on July 5 to the extent of twenty-five per cent of their stock holdings. The right to subscribe expired at the close of business on September 1. An underwriting syndicate has taken up the amount not subscribed for by stockholders. The response of the stockholders, many of whom live abroad, is considered unusually gratifying.

Directors of the Interborough Rapid Transit Company increased the dividend on the company's stock from nine per cent to ten per cent per annum and declared an extra dividend of one per cent. Of the $35,000,000 of stock on which the increased dividend will be paid, $33,912,800 is in the treasury of the Interborough-Metropolitan Company, having been exchanged by the holders for the four and one-half per cent bonds on the basis of $200 in bonds for each $100 of stock. It was announced by President Shonts that the increased dividends would be used to establish a sinking fund for the retirement of the $67,000,000 Interborough-Metropolitan four and one-half per cent bonds. The dividend on the Interborough Rapid Transit stock was increased from eight per cent to nine per cent in 1907.

Deposit of Chicago & Oak Park Elevated stock with Continental & Commercial Bank under minority stockholders' agreement is in excess of 14,000 shares or enough to make the merger plan operative.

It is officially stated that out of the $50,000,000 new stock recently offered by the American Telephone & Telegraph Company to its stockholders at par, in the ratio of one share to five held, only $300,000 remains untaken. This balance is supposed to represent absentee stockholders and will probably be taken up prior to the expiration of the time limit.

The Wilmington City Railroad Company, whose property is leased to the Wilmington & Philadelphia Traction Company and whose entire capital stock is owned by the Wilmington & Chester Traction Company, has sold $600,000 five per-cent fifty-year bonds to a syndicate headed by Scott & Company of Wilmington, Del. Proceeds of the new issue will be used to refund the $600,000 first mortgage fours which matured September 1.

DIVIDENDS.

Buffalo General Electric Company; regular quarterly dividend of one and one-half per cent on the common stock, payable September 30, to stock of record September 20.

Interborough Rapid Transit Company; quarterly dividend of two and one-half per cent, and an extra dividend of one per cent, both payable October 2.

Philadelphia Traction Company; semi-annual dividend of $2, payable October 2.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.	Sept. 11.	Sept. 4
Allis-Chalmers common	6⅜	6⅜
Allis-Chalmers Preferred	17	17
Amalgamated Copper	55¾	57¾
American Tel. & Cable	783/8	*783/8
American Tel. & Tel.	134⅝	134¼
Brooklyn Rapid Transit	73⅜	75⅝
General Electric	150	151
Interborough-Metropolitan common	14⅜	14½
Interborough-Metropolitan preferred	41⅞	43½
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	82½	82½
Mackay Companies (Postal Telegraph and Cables) preferred	72	72
Manhattan Elevated	134½	134
Metropolitan Street Railway	* 18	*18
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel.	36¾	37½
U. S. Steel common	67¾	69⅞
U. S. Steel preferred	114⅜	114½
Western Union	74½	74
Westinghouse common	64½	64
Westinghouse preferred	110½	112

BOSTON.	Sept. 11.	Sept. 4
American Tel. & Tel.	134½	134¼
Edison Elec. Illuminating	280	286
General Electric	150½	151
Massachusetts Electric common	18	17½
New England Telephone	86½	89
Massachusetts Electric preferred	145¾	146
Western Tel. & Tel. common	16	16½
Western Tel. & Tel. preferred	97	96½

PHILADELPHIA.	Sept. 11.	Sept. 4
American Railways	44¼	45
Electric Company of America	11⅞	12
Electric Storage Battery common	52¾	51½
Electric Storage Battery preferred	52¾	51½
Philadelphia Electric	16⅞	17
Philadelphia Rapid Transit	22¼	22½
Philadelphia Traction	85¼	84¾
Union Traction	50	50½

CHICAGO.	Sept. 11.	Sept. 4
Chicago Elevated Railways common	25	24
Chicago Elevated Railways preferred	88½	85
Chicago Railways, Series 1	91½	91
Chicago Railways, Series 2	29	28
Chicago Subway	2¾	2¾
Chicago Telephone	122	120
Commonwealth Edison	132½	132
National Carbon common	100	100
National Carbon preferred	103¼	115

PERSONAL MENTION.

F. D. WITWER, formerly of the Brilliant Electric Company, has become assistant manager of the Bryan-Marsh Company.

L. W. GILL, professor of electrical engineering in Queen's University, is the Canadian representative at the International Electrical Congress, being held in Turin, Italy.

CHARLES A. ROLFE, vice-president of the Southwestern Home Telephone Company, of Redlands, Cal., was a Chicago visitor this week. Mr. Rolfe is enjoying a vacation, and will spend some time at the baths at Mt. Clemens, Mich.

I. E. MOULTROP, mechanical engineer of the Edison Electric Illuminating Company, of Boston, is in Chicago, as the guest of the Commonwealth Edison, inspecting the new Northwest generating station of the company which is now nearing completion.

W. A. FOX, treasurer of the Commonwealth Edison Company, of Chicago, was recently elected a director and made vice-president of the Chicago & Oak Park Elevated Railway. Mr. Fox succeeds Redmond D. Stephens, who represented Blair & Company's interest in the road.

W. GODFREY BOYD, electrical engineer has been retained as consulting illuminating engineer by the Haskins Glass Company, of Wheeling, W. Va. Mr. Boyd will, in his present position, pay particular attention to the design of a new line of indirect and semi-indirect lighting units which the company is developing.

BENJAMIN T. DELAFIELD, who represented the Lunkenheimer Company for a number of years in the St. Louis and Kansas City territory, has become connected with the Best Manufacturing Company, of Pittsburg, Pa., to handle their power-plant material in the same territory. He will make his headquarters in Kansas City.

H. B. KIRKLAND, of Pittsburg, Pa., was married on September 14, to Miss Emily Roberts Houghton, daughter of Dr. and Mrs. Owen E. Houghton, of Brooklyn, N. Y. The wedding took place at the home of the bride's sister, Mrs. Girard B. Townsend, Montclair, N. J. Harry Kirkland is one of the best-beloved of the electrical fraternity. He has been long and favorably known, and a host of friends and acquaintances will join us in extending to him and to Mrs. Kirkland the heartiest felicitations.

JARED A. MUNROE, manager of the industrial department of the Bryan-Marsh Company has been in Chicago placing lighting installations in numerous factories and industrial plants. Two very large installations have been placed quite recently, one of these covering an area of nearly eight acres. Mr. Munroe was formerly manager of the Illuminating Engineering Company of Detroit, Mich., and has specialized in industrial lighting for the past three years. He was placed in charge of the newly established industrial lighting department of the Bryan-Marsh Company because of his valuable experience in placing industrial installations. The department now in his charge will be in a position to investigate a factory and show by citing previous instances of a similar nature just how large an increase in illuminating and how great a saving in power can be realized by well installed and properly designed lighting.

JARED A. MUNROE.

S. Z. DE FERRANTI, president of the (British) Institution of Electrical Engineers, is visiting America, and is at present in Chicago. He will return east on September 18, and after attending the convention of the Association of Edison Illuminating Companies, will make extended visits to Pittsburg, Niagara Falls and Schenectady. He will sail for Europe on the *Olympic* on September 30. Mr. de Ferranti has devoted a great deal of attention to the more perfect utilization of the energy available in coal, and to the exclusion of the conversion process from cities. He is now working upon a prime mover which will utilize superheated steam, and has already obtained an efficiency of twenty-five per cent between the coal pile and the generator. This is more than double the usual efficiency obtained today.

OBITUARY.

THOMAS A. DEEN, who has for the past twenty-five years been well known among the electrical contractors of Pennsylvania, died recently at his home in Lancaster, Pa. Mr. Deen was at one time chief engineer for the Uited States Electric Lighting Company, the first lighting company in Lancaster. In 1882 he was made chief engineer of the Edison Electric Illuminating Company in which capacity he served for two years. Leaving the Edison company he entered the contracting field in Lancaster, his firm now being one of the oldest in that city. The business will be continued under the name of Thomas A. Deen Estate.

NEW PUBLICATIONS.

THE MOUNTAIN STATES MONITOR.—The first number of this monthly magazine devoted to the interests of the Mountain States Telephone & Telegraph Company appeared in August. The magazine is published at Denver, Colo.

COLOMBIAN MAHOGANY.—The publication takes up the use and characteristics of *Cariniana pyriforms* which, although it does not belong to the same family as the true mahogany has some of its external characteristics. It is widely used as a substitute for mahogany, a large amount being shipped from Cartagena, Colombia, annually.

LANGLEY MEMOIR ON MECHANICAL FLIGHT.—The work follows Professor Langley's publications on "Experiments in Aerodynamics," and "The Internal Work of the Wind," and is printed as Part 3 of volume 27 of the Smithsonian Contributions to Knowledge. The subject is taken up from both a mathematical and experimental standpoint, numerous diagrams and half-tone engravings being included.

ELECTRICAL CODE OF NEW YORK CITY.—The Department of Water Supply, Gas and Electricity of the City of New York, has published a new electrical code applying to that city. This code is based upon the National Electrical Code, departures from the latter having been made only when modifications were necessary or desirable on account of local laws and conditions. Copies of the new code can be obtained upon application to the Bureau of Electrical inspection, 13 Park Row, and constructive criticism of the code is invited.

PROPOSALS.

WIRING.—Proposals will be received at the office of the Supervising Architect, Washington, D. C., until October 6, for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and lighting fixtures), of the United States postoffice at Pendleton, Oregon, in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Pendleton, Ore., or at the Supervising Architect's office. Proposals will be received until October 9, for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring and lighting fixtures, of the United States postoffice at Winchester, Ky.

INDUSTRIAL ITEMS.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has issued the September number of its magazine *Trumbull Cheer*. The issue lists a line of Trumbull panel boards and combination switches.

THE D & W FUSE COMPANY, Providence, R. I., describes its magnetic chucks in a folder which was issued a short time ago. The chucks are manufactured for both surface grinding, planing and milling. Rotary chucks are made for ring and cup grinding.

THE OTIS ELEVATOR COMPANY, New York, N. Y., describes the new Chicago & Northwestern railway station at Chicago in the August number of *The Indicator*. This number also contains a continuation of an article entitled "Principles of Electro-Dynamics."

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, Mo., has removed its main offices from their long established location, 2115 Locust Street, to the Equitable Building, Suite 507, thus bringing the company into the main business district of St. Louis.

W. N. MATTHEWS & BROTHER, St. Louis, Mo., is mailing a folding post card illustrating the use of the Matthews guy anchor. The card has a return portion arranged for convenience in ordering. Slips inserted in the card advertise the Matthews two-bolt guy clamp and the Matthews cable clip.

BUREAU OF STANDARDS, Washington, D. C., has issued a new edition of Circular No. 6, containing fees for electric, magnetic and photometric testing. All of these subjects are grouped together in the present circular and certain changes have been made in the fees since the original publication of the schedules.

ECONOMY ELECTRIC COMPANY, Warren, O., is distributing calendars containing reproductions of the birthplaces of famous Americans. The September card illustrates the birthplace of James Russell Lowell. A complete set of these beautiful reproductions in color will be sent by the Economy Electric Company upon request.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., announces that it has taken over the exclusive handling of the Nicholson arcing rings. These rings are already in service on the lines of the Niagara, Lockport & Ontario Power Company, Chicago Sanitary District, Syracuse Rapid Transit Company and many other installations.

THE BELL ELECTRIC MOTOR COMPANY, Garwood, N. J., illustrates its line of single-phase motors in a recent bulletin. These motors make use of no condensers, phase-splitters, compensators or transformers for starting. The motor is a complete unit in itself, possessing a starting torque similar to that of a direct-current series motor, and does not require a friction clutch or similar device.

ALFRED F. MOORE, 200 North Third Street, Philadelphia, Pa., is putting upon the market a line of enamel-insulated wires, which when desired can be covered with an additional layer of silk or cotton. Stocks of this wire are carried in Chicago and Cleveland, as well as at the factory. All wire is thoroughly tested before leaving the factory so that a uniform product of high standard is assured.

THE SEIDLER-MINER ELECTRIC COMPANY, the well-known electrical contracting and supply house which has done business in Detroit for the past twenty years, has recently added to its activities by entering the field as a wholesale jobber and manufacturer's agent. For this purpose the building at 207 Jefferson Avenue, which the company has occupied for a number of years, has been remodeled and a full line of new and standard electrical supplies is now carried in stock.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., tells "Hotpoint" dealers, in the August number of its magazine *Hot Points*, to prepare for the return of the "bill raisers." An attractive folder has also been mailed telling of the objects and scope of the "bill-raisers" campaign and containing a reproduction of the page advertisement which appears in the September 16 number of the *Saturday Evening Post*. This advertisement explains to the central-station customer just why his bills increase as winter comes.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., reprints in the September issue of the *Emerson Monthly* an abstract of an article appearing in a publication of the H. C. Roberts Electric Supply Company. The article deals with the electric store and is interesting and to the point. A plea is made for the modern retail electric supply store in our smaller cities, not merely as an unimportant adjunct to a contracting business, but as a business standing on its own feet. A store which compares favorably with the best store in town would, the author states, get the business.

THE HURLEY MACHINE COMPANY, Chicago, Ill., has sent out copies of its new illustrated Catalog A showing designs of modern laundry rooms and illustrating and describing the special line of Thor electric laundry machines arranged for permanent installation. The statement is made by the manufacturers that this complete line of machines was brought out because of the many requests received from architects and builders for a machine which could be permanently installed. The washers are made in various sizes and are of solid porcelain, cast iron, white enamel, copper, zinc or galvanized steel.

MACHEN & MAYER ELECTRICAL MANUFACTURING COMPANY, Philadelphia, Pa., is distributing a booklet in which are listed the M. & M. specialties. In conection with the flush push-button switch, twelve special features are noted, each of which adds to the strength, durability or satisfactory operation of the switch. It might be added that in a recent test of M. & M. switches which were selected at random, these withstood more than 1,000,000 makes and breaks. Illustrations of the various types of switches, receptacles, conduit boxes, indicating heater receptacles, etc., are included in the booklet, prices being given for each.

THE HOPE ENGINEERING & SUPPLY COMPANY, Pittsburg, Pa., announces that it has secured the services of Louis Bendit as manager of its western office at the New York Life Building, Kansas City, Mo. Mr. Bendit will have associated with him a corps of experienced engineers and will be prepared to give careful attention to all inquiries in consulting and contracting engineering along the line of natural gas. He will also have charge of its sales agencies of Miller gas and oil engines, 25 to 400 horsepower, C. & G. Cooper gas engines, 300 to 2,000 horsepower, Hammon gas-pipe couplers, and Sprague gas meters.

THE AUTOMATIC ELECTRIC WASHER COMPANY, Newton, Iowa, through its president, Harry L. Ogg, is making a personal appeal to the live dealers of the country to handle the Automatic Washer. Mr. Ogg has devised a plan that will enable dealers to sell automatic washing machines with comparative ease. Mr. Ogg wil be glad to send full information to any central station or dealer who is interested in this proposition. The Automatic Washer met with almost instantaneous success when it was placed on the market, and the company has been obliged to increase its facilities a number of times to keep up with the constantly increasing demand.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y. has received an order from the Pacific Mills, Lawrence, Mass., for a 1,000-kilowatt, three-phase, sixty-cycle, 600-volt horizontal Curtis Turbine. Over 11,000 horsepower of General Electric motors are now installed in these mills. The Des Moines City Railway Company, Des Moines, Iowa, has placed an order with the General Electric Company for a 2,000-kilowatt, twenty-five cycle, mixed-pressure turbine, and a seventy-five kilowatt turbo-exciter. The turbine will take steam from two engines driving 1,000 kilowatt direct-current generators, and its installation will improve the economy and increase the capacity of the present station.

THE MAYTAG WASHER COMPANY, Newton, Iowa, makers of the well known Maytag electric washing machine, states that it is meeting with excellent success in the placing of its electric washing machines among the central stations, and users in general. The Maytag Company claims that its machine has a number of features not possessed by other makes. It is simple, durable and quiet, easy running, and there is no weight on the lid. All

the working parts are protected, and one operating handle controls the washer, ringer and reverse. There is nothing to get out of order, there are no vibrating levers in the way, and all working parts are on the left side, out of the operator's way. The company would be glad to send a full description to any central station on request.

THE FOSTORIA GLASS SPECIALTY COMPANY, Fostoria, O., lists and illustrates in its new 100-page catalog entitled "Illuminating Glassware," more than 1,550 different styles of clear-cut and etched globes, shades and reflectors for electric and gas lamps. In respect to the number of styles illustrated, this is probably the most comprehensive catalogue ever distributed by an American glass company; it is in fact a veritable reference work on the numerous schools of design and profusion of shapes exemplified in modern decorated illuminating glassware. The book itself is most attractively put together, and in spite of its scope is not at all unwieldy. It will be mailed gratis to persons interested in its contests from a commercial or a professional standpoint. Applications should be made to the company's headquarters at Fostoria, O., and should specify "Catalogue No. 52.". "Iris," or iridescent glassware, is described in a separate publication by the same company.

THE UNION LIGHT & SUPPLY COMPANY, New York Life Building, Chicago, Ill., distributors in the United States for the "Just" (Wolfram) tungsten lamps, states that it has met with great success in placing this lamp among users in the West. The Union Company claims that the "Just" lamp is giving entire satisfaction and has shown a remarkably long life. The distributor claims that it installed 114 one hundred-watt, round-bulb, "Just" lamps in the office of the Hartford Fire Insurance Company, New York Life Building, Chicago. These lamps were installed in February, 1910, have been in constant use since then, and during this time only three lamps have been replaced. Another installation to which the company points with pride was made in the Fine Arts Building, Chicago. It consisted of two 450-watt, "Just" lamps, eight inches in diameter, totally frosted, and although the lamps have been burning on an average of fifteen hours a day since November 1, 1909, in a dark corridor, they are still in perfect condition. These two lamps have burned over 10,000 hours.

THE NATIONAL CARBON COMPANY, Cleveland, O., has issued a booklet, entitled "Analogies between Battery Current and Water Flow." It is an explanation of the electrical expressions commonly applied to dry cells in terms of water current and flow. The comparisons between water flow, pressure, current, etc., to the same thing in electrical current cannot be misunderstood. The book is profusely illustrated so as to make a visual explanation of the points brought out, in addition to the word-description. The National Carbon Company has taken the initiative in issuing such educational literature at frequent intervals for the benefit of any one interested in electrical matters, particularly along the lines where their products are used. They have one of the largest private technical and physical laboratories in the world, where men of national reputation are constantly delving into various problems connected with the company's business, while others are devoting exclusive time to the preparation and distribution of informaation such as the above. It is quite natural to believe that the better educated the public is the more easy will it be for the company's salesmen to make explanations regarding the high quality of product which the company is making.

Copies of the book will be sent free to those who desire them. It has a very attractive cover page and the typographical arrangement, color scheme, and paper stock all tend to make the book pleasing to the eye.

DATES AHEAD.

International Municipal Congress and Exposition. Chicago, Ill., September 18-30.

Association of Edison Illuminating Companies. Annual convention, Spring Lake, N. J., September 19, 20 and 21.

Northwest Electric Light and Power Association. Annual convention, Spokane, Wash., September 21-22.

American Electrochemical Society. Twentieth general meeting, Toronto, Canada, September 21-23.

Illuminating Engineering Society. Annual convention, Chicago, Ill., September 25-27.

National Conservation Congress, Kansas City, Mo., September 25, 26 and 27.

American Mining Congress. Thirteenth annual meeting, Chicago, Ill., September 26-29.

Georgia Section of the National Electric Light Association. Annual convention, Columbus, Ga., September 26 and 27.

National Association of Cotton Manufacturers. Semi-annual meeting, Equinox House, Manchester, Vt., September 27-30.

American Electric Railway Association and affiliated associations. Annual convention, Atlantic City, N. J., October 9-13.

New York Electrical Exposition, New Grand Central Palace, New York, N. Y., October 11-21.

Denver Electric Show. Denver, Colo., October 14-21.

Association of Railway Electrical Engineers. Annual convention, La Salle Hotel, Chicago, November 6-10.

National Electric Light Association. Next annual convention, Seattle, Wash., June 10-14, 1912.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) September 5, 1911.

1,002,222. TELEPHONE SYSTEM. Henry P. Clausen, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. Filed July 18, 1903. Relates to details of the line and cut-off relays and their control of the line and supervising signals.

1,002,232. ALARM FOR CASH BOXES. William E. Dawson and Robert McAlpine, Detroit, Mich., assignors of one-fourth to William D. Southwick and one-fourth to Harry J. Booth, Detroit, Mich. Filed Sept. 11, 1908. Associated with a desk telephone is a cash box that has an alarm circuit connected with the lock and passing through the cord. An attempt to turn the lock or to sever the cord of the instrument operates the alarm.

1,002,233. ELECTRODYNAMIC BRAKE FOR ALTERNATING-CURRENT MOTORS. William N. Dickinson, Jr., Brooklyn, N. Y., assignor to Otis Elevator Co., Jersey City, N. J. Filed Dec. 20, 1905. Mechanically connected to the motor is a direct-current generator which is energized on reversal of the motor and then sends a current into the motor field so as to affect an electrodynamic brake action on the motor.

1,002,238. TELEPHONE ATTACHMENT. Gustavus Abeel Duryee, New York, N. Y. Filed May 13, 1908. Mounted upon the transmitter is a sound-proof casing containing a yielding mouthpiece adapted to engage the speaker's mouth.

1,002,239 and 1,002,240. TELEPHONE SYSTEM. Alfred H. Dyson, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. Filed April 11, 1902. These two patents cover a trunking system between exchanges including a grounded trunking line with supervisory relays, signals, etc.

1,002,249. ELECTRICAL OXIDATION OF NITROGEN. Carleton Ellis, Montclair, N. J., assignor to Ellis-Foster Co. Filed June 6, 1911. Consists in forming an elongated electric arc, passing a current of preheated air of constant moisture content concentrically about and in planes at right angles to the normal axis of the arc and in causing the arc to be deviated from its normal axis and revolve thereabout at a speed slightly less than that of the rate of travel of the gaseous current.

1,002,253. HOT-WATER-BAG HEATER. Thomas E. Fogalsang and Bertha McCutcheon, San Francisco, Cal., assignors to Joseph A. Moross, San Francisco, Cal. Filed Oct. 12, 1910. Combined with the bag is a stopper therefor of dielectric material in which are embedded a pair of wires, electrodes connected with the wires and projecting within the bag, but removable therefrom with the stopper, and an enlargement fixed to the electrode within the bag and carried by the electrodes and co-operating with the stopper to hold the electrodes out of contact with the bag.

1,002,258. APPLIANCE FOR PRODUCING ARTICLES BY ELECTRODEPOSITION. Frank Iorns Gibbs, Birmingham, England. Filed Aug. 16, 1910. A model is formed of vitreous material that is hollow and provided with inner and outer deposit-receiving surfaces consisting of a metallic luster burned into and combined with the glaze, and leads electrically connecting the inner and outer surfaces.

1,002,267. MORSE TRANSMITTER. Theodore Habermann, Hemslingen, near Brockel, Germany. Filed Jan. 14, 1911. Comprises a number of series of electric contacts, the contacts in each series representing by their length and order of sequence the dots and dashes constituting one of the code characters, means for severally moving the contact series, means whereby the contacts in each moved series successively close the transmitter circuit, and audible signal devices automatically actuated on completion of the movements of the contact series.

1,002,277. TELEPHONE SYSTEM. Arthur R. Kahl, Rochester, N. Y., assignor to Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. Filed July 16, 1907. Relates to a scheme of connection between an automatic and a manual exchange.

1,002,286. METHOD OF ELECTRIC PRODUCTION OF IRON AND STEEL AND OTHER METALS. Axel Rudolf Lindblad, Ludvika, Sweden. Filed March 6, 1909. An electric furnace is fed by a two-phase circuit connected to adjustable electrodes over the bath, the latter being connected to the neutral point.

1,002,336. INDUCTION-MOTOR-CONTROLLING APPARATUS. August Sundh, Yonkers, N. Y., assignor to Otis Elevator Co., Jer-

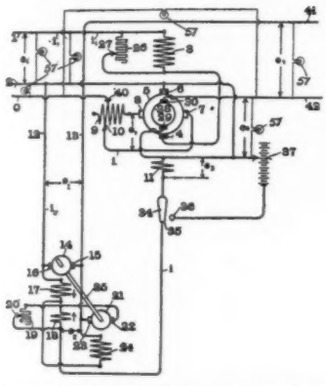
sey City, N. J. Filed Nov. 16, 1905. Includes a valve for controlling the speed-controlling means, a device operated by fluid pressure for actuating the valve electro-responsive valve-restoring means, and brake apparatus controlled by the latter.

1,002,348. RAIL BOND. William H. Wherry, East Cleveland, Ohio. Filed June 14, 1905. Consists of a continuous strand or strip of copper wound into a coil having superimposed layers, each such layer comprising a number of turns of the strand.

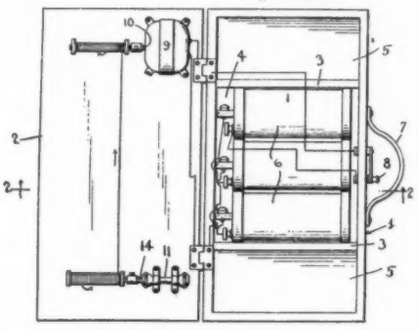
1,002,357. IGNITER FOR ENGINES. William K. Bassford, Perth Amboy, N. J. Filed April 2, 1910. An armature is fixed on a sleeve through which a driving shaft passes loosely. A governor is mounted on the shaft and geared to the sleeve so as to regulate the speed of the armature.

1,002,383. DYNAMO-ELECTRIC MACHINE. Valere Alfred Fynn, London, England, assignor to Wagner Electric Manufacturing Co., St. Louis, Mo. Filed Nov. 29, 1909. Combined with a stator carrying a neutralizing winding is a rotor with working brushes on it connected in series with the neutralizing winding. There are also exciting brushes on the rotor, an independent source of electromotive force, and means for producing a teaser flux along an axis displaced from the axis of the exciting brushes, the magnitude of the flux depending on the difference between the independent electromotive force and an electromotive force derived from the working circuit.

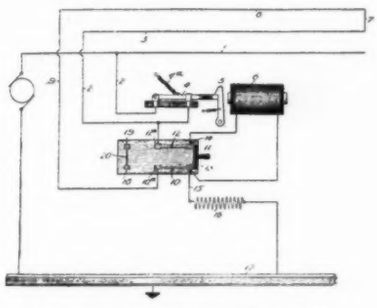
1,002,388. METHOD OF AND MEANS FOR CONNECTING TELEPHONE APPARATUS. Ernest A. Gray, Boston, Mass., assignor to American Telephone & Telegraph Co., Boston, Mass. Filed July 30, 1907. The method of connecting telephone conductors between primary points and other points consists in rendering the conductors available at groups of primary points arranged in permutations and arranging the conductors to be available at their primary points in a definite order with reference to the availability of other conductors.



1,002,383.—DYNAMO-ELECTRIC MACHINE.



1,002,435.—COIL WINDER.



1,002,544.—AUTOMATIC CUT-OUT.

1,002,390. ANODE FOR X-RAY TUBES. Henry Green, Hartford, Conn. Filed March 28, 1908. The anode body and the target, comprising a back plate of material having a high heat conductivity, and the face plate of highly refractory material are permanently and inseparably secured together with their opposing faces in actual contact throughout their entire area.

1,002,435. COIL WINDER. Peter Oswald, Alma, Neb. Filed April 24, 1911. Mounted in a portable case are a number of dry cells. Secured to the hinged cover is a small motor connected to the cells and adapted to drive a shaft on which the coil core or a chuck is placed.

1,002,444. ELECTRIC-RESISTANCE FURNACE. Albert Petersson, Odda, Norway. Filed May 25, 1910. Has two superposed electrodes between which the charge forms a vertical resisting conductor. On either side of the upper electrode are plungers that force the material against it, so as to prevent the forming of arcs.

1,002,462. SUSPENSION-LOOP FOR INITIAL CATHODE SHEETS. Edward L. Sibley, Bennington, Vt. Filed July 29, 1910. A wide flat sheet metal loop is hung over a conducting rod and at its lower ends is secured the cathode sheet.

1,002,475. WIRE CABLE AND THE LIKE COVERING MACHINE. Otto Vogel, Berlin, Germany, assignor to Fabrik Isolirter Drähte (vormals C. J. Vogel Telegraphendraht-Fabrik) Aktiengesellschaft, Adlershof, Germany. Filed Sept. 9, 1908. The wire passes through a tubular shaft to which is secured a flier that winds the insulation upon the wire.

1,002,482. PROCESS OF MAKING DUPLICATE SOUND RECORDS. Jonas W. Aylesworth, East Orange, N. J., assignor to Thomas A. Edison, Incorporated, West Orange, N. J. Filed Jan. 29, 1908. Metallic records are made by applying an excessively thin film of hydrocarbon on the record surface of a matrix, then applying graphite thereto, then lightly burnishing the conducting surface, then electrodepositing a metal on the same, and finally separating the electrodeposited metal from the matrix.

1,002,484. CONTROLLING DEVICE FOR ELECTRIC MOTORS. Thomas Barnard, Toronto, Ontario, Canada, assignor to Eastman Machine Co., Limited, Toronto, Canada. Filed March 3, 1910. Has a vertically moving plunger that wipes the armature and field resistance contacts step by step.

1,002,527. OIL-COOLED TRANSFORMER. Otto Kulka, Hamburg, Germany, assignor to Carl Frank Sander, Hamburg, Germany. Filed Sept. 21, 1910. The casing of an oil-cooled transformer is provided with an inverted siphon having its bend below the normal level of oil in the casing, and allowing oil to flow into or from the casing.

1,002,533. RESISTANCE BOX. Louis A. de Mayo, New York, N. Y. Filed March 20, 1909. The resistance elements are in the form of rods extending through supporting plates and connected by clips.

1,002,544. AUTOMATIC CUT-OUT FOR ELECTRIC CIRCUITS. Eugene S. Sears, Chicago, Ill., assignor of one-third to Howard J. Peters and one-third to Fred D. Fox, Chicago, Ill. Filed July 25, 1910. The two trolley wires of a double-track electric railway are connected in series, a conductor connecting the trolley wires to ground. A feed tap supplies current from the main feed to the trolley wires, a switch in the feed tap being normally locked in closed position. An electromagnet is arranged when energized to release the switch, the electromagnet having its coils in shunt with the trolley wires and normally short-circuited thereby. A switching mechanism is arranged to open the circuit of the electromagnet and to connect the trolley wires in parallel.

1,002,563. SENDER FOR AUTOMATIC TELEPHONE SYSTEMS. Edward E. Clement, Washington, D. C. Filed Nov. 11, 1905. Comprises a circuit-breaking mechanism for transmitting a series of impulses, a movable operating member having a finger hold, for actuating the circuit-breaking mechanism, and a fixed limiting member having a plurality of finger holds spaced apart from each other in the path of movement of the operating members. The finger hold in the movable member and all the finger holds on the fixed limiting member are within the span and range of movement of one hand of the operator.

1,002,567. SOUND-RECEIVING DEVICE. Sidney M. Davison, Cambridge, Mass. Filed April 22, 1909, Serial No. 491,637. Renewed May 25, 1910. Apparatus for finding the direction from which sound comes has two metal shells; one being located within the other. An electric transmitter is disposed within the inner shell.

1,002,574. CHAIN GUIDE FOR ELECTRICAL PULL-SOCKETS. Edgar H. Freeman, Trenton, N. J., assignor to E. H. Freeman Electric Co., Trenton, N. J. Filed June 2, 1911. The two parts of the guide body have a slot which may be closed by turning the movable part of the attachment.

1,002,595. ELECTRIC SWITCH. James F. McElroy, Albany, N. Y., assignor to Consolidated Car Heating Co. Filed Nov. 17, 1910. Comprises two stationary contacts, two movable contacts, means for operating the movable contacts, a magnet having its energizing coil and one pole between the two sets of contacts and two opposite poles outside of both sets, together with interposed insulation on the pole faces forming a separate inclosure for each set.

1,002,596. DOOR MOTOR. James F. McElroy, Albany, N. Y., assignor to Consolidated Car Heating Co. Filed March 7, 1911. Has stationary and movable electric contacts, and a split casing inclosing the stationary contacts while permitting the entrance of the movable contact, each side of the casing being adapted to be opened outward to permit the inspection of the contacts.

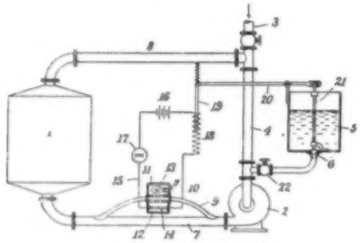
1,002,608. METHOD OF TREATING EMERY ORE. Frank J. Tone, Niagara Falls, N. Y., assignor to Carborundum Co., Niagara Falls, N. Y. Filed Nov. 14, 1908. Pulverized emery ore is mixed with a quantity of carbon sufficient to reduce the constituents of the ore other than alumina and insufficient to reduce the alumina. This mixture is interposed between the elec-

trodes of a furnace, and current passed at a temperature below the reduction temperature of alumina, and above the reduction temperature of silica, allowing the fused mass to cool and separating the reduction products from the fused alumina.

1,002,622. ARC LAMP. John Albertis Ziegenfuss, Caney, Kan. Filed Nov. 18, 1909. Has a slotted member, an angular member having a reduced portion which extends through the slot and is provided with a roller, the angular member having a threaded portion. A carbon holder is threaded to this and is provided with a flange arranged adjacent the slotted member, the carbon holder having arms and being provided with a lower cylindrical portion from which the arms project. These arms are designed to engage and support a carbon, a vertical movable member engaging the roller of the angular member for raising the holder and its carbon.

1,002,635. APPARATUS FOR MEASURING AND REGULATING THE CONCENTRATION OF DYE LIQUORS. Wladislaus Bratkowski, Berlin, Germany. Filed March 10, 1911. Serial No. 613,619. An incandescent lamp supplied from a source of constant voltage, shines through a glass tube through which the dye-stuff flows. The transmitted light falls on a selenium cell connected in circuit with an ammeter and a solenoid. When the dye color becomes too weak the solenoid opens a valve in a chamber containing concentrated dye, allowing this to strengthen the used dye to the proper depth of color.

1,002,645. ELECTRODE FOR ARC LAMPS. Wallace T. Conn, Lakewood, O., assignor to National Carbon Co., Cleveland, O. Filed April 1, 1909. Has a main electrode portion, and means for maintaining the arc at the end of the electrode comprising a coating of insulating material about said main portion, and a shell of carbon surrounding the insulating coating.



1,002,635.—DYE REGULATOR.

1,002,647. ELEVATING JACK FOR MULTIPLE WIRES AND CABLES. Thomas J. Cope, Philadelphia, Pa. Filed Feb. 20, 1911. Is composed of a wedge-shaped body, and a conical roller mounted on a side and extending in the direction of the length of the body.

1,002,648. RELAY CONTACT. Fred B. Corey, Schenectady, N. Y., assignor to General Electric Co. Filed Sept. 3, 1909. The contact is made of molybdenum.

1,002,658. METHOD OF TREATING MOLDS USED IN THE ART OF ELECTROTYPING. George E. Dunton, New York, N. Y. Filed Nov. 11, 1910. The mold is treated with a mixture of grease and an electrical conducting material, which mixture may be easily removed.

1,002,687. DYNAMIC BRAKE CONTROLLER. Clark T. Henderson, Milwaukee, Wis., assignor to Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Filed Sept. 6, 1907. Renewed Feb. 4, 1911. A variable resistance is connected across the terminals of the motor armature, means being supplied for arresting the removal of the resistance from circuit when the armature current rises above a predetermined value. A mechanical brake is operatively connected with the armature, and electroresponsive means energized upon closure of the motor circuit for rendering said mechanical brake inoperative until the current through said armature falls to a predetermined point.

1,002,711. SYSTEM FOR THE TRANSMISSION OF ELECTRICAL ENERGY. Charles D. Lanning, Boston, Mass. Filed Aug. 8, 1907. A two-way repeating device comprises one or more repeating instruments and circuit-controlling means, these being controlled by sound-caused electric currents and so disposed as to vary, establish and maintain the circuits to and from the repeating device in response to the direction of sound-transmission from the speaking to the listening station.

1,002,712. ELECTRO-MAGNETIC DEVICE FOR ALTERNATING CURRENTS. Charles D. Lanning, Boston, Mass. Filed Aug. 2, 1910. A modification of the preceding patent.

1,002,713. SELECTIVE SIGNALING SYSTEM. Oscar M. Leich, Chicago, Ill., assignor of one-third to J. G. Ihmsen and two-thirds to P. C. Burns, Chicago, Ill. Filed May 3, 1901. Alternating current of different frequencies is impressed on the line operating signal devices responsive to these frequencies. Each station circuit is non-tuned or non-resonant for the particular frequency by which its alloted signal-receiving device is operated.

1,002,718. INDUCTION MOTOR. Ercole Marelli, Milan, Italy. Filed Feb. 19, 1909. The face of each pole piece of a single-phase induction motor is eccentric to the motor armature.

1,002,721. ELECTRIC-AIR FURNACE HEATER. Ezra A. Mathers, New York, N. Y., assignor to Hub Machine, Welding & Contracting Co., New York, N. Y. Filed Aug. 9, 1910. Has a casing, a plurality of movable carbons forming a discharge opening therefrom, means for forming an arc flame in the casing, and means for discharging compressed air into the casing, whereby the flame is formed through the opening.

1,002,735. AUTOMATIC TELEGRAPH-KEY CLOSER. Dorace E. Motz and Frederick B. Hatfield, La Jara, Colo. Filed Oct. 4, 1910. A secondary lever is employed to hold the key in a closed position.

1,002,745. ELECTRIC RAILWAY GATE. John Allen Nungesser and Geore Fredrich Klein, Galion, O. Filed Nov. 8, 1910. A motor operates the gear movements which open the gate.

1,002,758. CONTACT FOR ELECTRIC WELDING MACHINES. Adolph F. Rietzel, Charlestown, R. I., assignor to Thomson Electric Welding Co., Lynn, Mass. Filed Aug. 25, 1908. Has a pair of pressure current-carrying blocks, one fixed and the other movable toward and away from the first, and an intermediate contact located between the current-carrying blocks and movable into and out of engagement with the work independent of the movement of the blocks.

1,002,766. CONTROLLER FOR ELECTRIC MOTORS. Adolph W. Schramm, Riverton, N. J., and Edward B. Wilford, Merion, Pa., assignors to Electro Dental Manufacturing Co., Philadelphia, Pa. Filed July 10, 1911. The operating lever may be locked in any one of a number of definite positions. Locking is done by means of a toothed member.

1,002,783. DETACHABLE TELEPHONE SUPPORT. Burton W. Sweet, Cleveland, O., assignor to Harry Z. Sands, Cleveland, O. Filed March 23, 1907. A support made of a number of hinged members, stamped from sheet metal.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired September 11, 1911:

525,689. ELECTRIC TRANSFORMER. Charles S. Bradley, Avon, N. Y.

525,690. ELECTRIC-RAILWAY SYSTEM. Charles S. Bradley, Avon, N. Y.

525,698. ARMATURE FOR DYNAMO-ELECTRIC MACHINES. Rudolph Eickemeyer, Yonkers, N. Y.

525,702 and 525,703. TELEPHONE-CALL SYSTEM. Ezra T. Gilliland, Pelham Manor, N. Y.

525,704. ELECTRIC CLOCK. Fred L. Gregory, Chicago, Ill.

525,730. ELECTRIC FAN. Charles Wachtel, Newark, N. J.

525,735. ELECTRIC ARC LAMP. Stewart L. Campbell, Kalamazoo, Mich.

525,743. ELECTRIC ARC LAMP. Alexander B. Roney, Chicago, Ill.

525,769. SYSTEM OF ELECTRICAL DISTRIBUTION. James F. McElroy, Lansing, Mich.

525,779. SYCHRONIZING MECHANISM FOR ELECTRIC CLOCKS. Edgar Ayres, Sydney, New South Wales.

525,782. COMBINED BRAKE AND ELECTRIC SWITCH FOR STREET-RAILWAY CARS. George Brown, Long Island City, N. Y.

525,828. ELECTRICAL IGNITER FOR GAS OR HYDROCARBON ENGINES. Paul A. N. Winand, Philadelphia, Pa.

525,836. SELF-ADJUSTING BRUSH FOR DYNAMO-ELECTRIC MACHINES. William L. Bliss, Brooklyn, N. Y.

525,840. LIGHTNING ARRESTER. Archibald L. Courtright, Keokuk, Iowa.

525,864. ELECTRIC RAILWAY. Herbert E. Rider, New York, N. Y.

525,866. ELECTRIC SIGNALING APPARATUS FOR RAILWAYS. Paul Schwenke, Zerbst, Germany.

525,874. ELECTRIC ANNUNCIATOR. Henry C. Thomson, Boston, Mass.

525,886. TROLLEY FOR ELECTRIC RAILROADS. Edward Dawson, Terre Haute, Ind.

525,888. MANUFACTURE OF CARBONS FOR ELECTRIC LAMPS. Thomas A. Edison, Menlo Park, N. J.

525,891. FASTENER FOR ELECTRIC WIRES. Harry C. Fricke, Pittsburg, Pa.

525,929. SPARK SHIELD OR PROTECTOR FOR ELECTRIC ARC LAMPS. William M. Thompkins, Philadelphia, Pa.

525,936. ELECTRIC SWITCH. George Baehr, Jersey City, N. J.

525,943. ELECTRIC ARC LAMP. Harold E. Bradley, New Bedford, Mass.

525,945. CONDUIT SYSTEM FOR ELECTRIC RAILWAYS. William C. Creighton, Chicago, Ill.

525,992. SYSTEM OF LIGHTING AND HEATING CARS BY ELECTRICITY. Morris Moskowitz, Newark, N. J.

525,993. MEANS FOR EQUALIZING ELECTROMOTIVE FORCE OF DYNAMOS. Morris Moskowitz, Newark, N. J.

526,016. ELECTRIC MOTOR. John S. Losch, Summit Station, Pa.